ELECTRICAL WEST

SPOKESMAN FOR THE MOST HIGHLY ELECTRIFIED SECTION OF THE U. S.

Graw-Hill Co.
f California

MAY 1945

25c a Copy

THE DOINGS OF REDDY KILOWATT ON A MODERN
How Reddy K
helped Petuni
Little Petunia's mother wa
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Reddy Kilowatt, the electri
an ultra-violet
for
OINGS OF REDDY KILOWATT ON A MODERN DAIRY FARM
How Reddy Kilowatt
saved time
Little Petunia, the
"Boss" was able to
bottles and dairy
Reddy Kilowatt,
Petunia that he
hours every day
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tric sterilizer,
promised to
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One of the
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tages.
MODERN DAIRY FARMING
THE DOINGS OF REDDY KILOWATT ON A MODERN DAIRY FARM
How Reddy Kilowatt
helped Petunia get well
When little Petunia curled up in a corner
of kicking up her heels in the pasture as
the "Boss" knew he had a sick calf on his
But his electrical "hired hand," Reddy Kilow
was right on the job with an Electric Heat La
The "Boss" didn't have to carry hot water
with water bags for hot packs because the
provided plenty of dry, safe heat that q
made Petunia well.
Operating Electric Heat Lamps is one of
ways in which Reddy Kilowatt saves time
and money on the modern dairy farm.
these days, electrical equipment will
available.
You can learn more about
of electrical dairy equipment
free copy of "Modern Dairy
Southern California Edison
Ltd., P.O.
Los
MODERN DAIRY FARMING
Edison

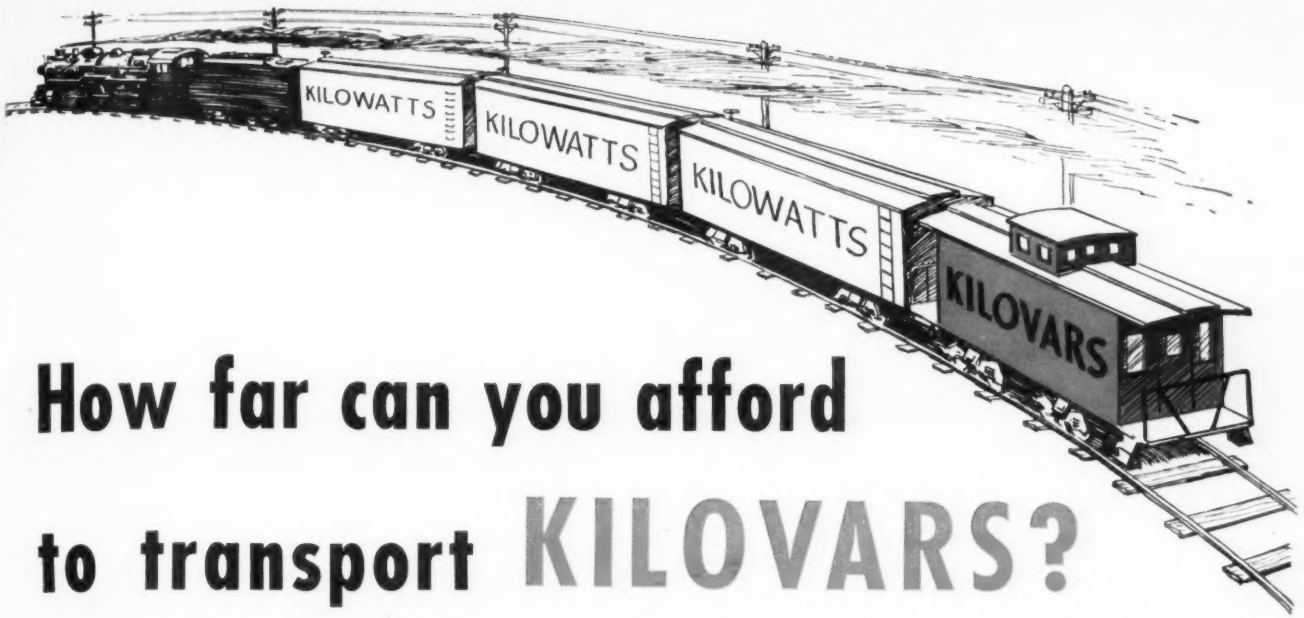
"Reddy" and "Petunia"

EDISON AMBASSADORS TO THE DAIRY FARMERS

Dairy farmers in Southern and Central California know Reddy Kilowatt and Little Petunia, the calf, through their regular appearances in leading dairy publications in this area. Featured in Edison Company advertisements, some of them shown here, Reddy and Petunia have continued to promote the advantages of electrical dairying methods even though new equipment has not been obtainable. Dairy and farm equipment manufacturers and dealers can look to these two Edison "ambassadors" to help sell their products after the war.

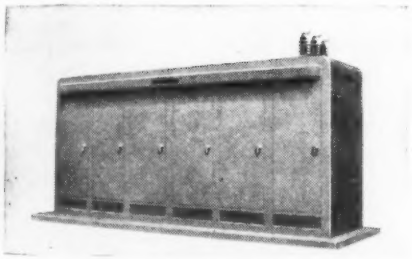
SOUTHERN CALIFORNIA EDISON COMPANY, LTD.

ELECTRICAL WEST (with which is consolidated The Journal of Electricity), May, 1945. Vol. 94, No. 5. Published monthly by the McGraw-Hill Company of California, 68 Post Street, San Francisco, 4, Calif. Entered as second class matter at the post office at San Francisco under the Act of March 3, 1879. Additional entry as second class matter at the post office at Los Angeles. Printed in U. S. A. Subscription rates—U.S., U.S. Possessions and Latin American Republics: $2, 1 year; $3, 2 years; $4, 3 years. Canada: $2.50, 1 year; $4, 2 years; $5, 3 years. Other countries: $3, 1 year; $5, 2 years; $6, 3 years. Single copy, 25c. Copyright, 1945. McGraw-Hill Company of California.



How far can you afford to transport KILOVARS?

Seldom as far as you carry the kilowatts



Attractively styled Pyranol capacitor equipments with or without switchgear are now available for supplying your bulk kilovar requirements. Large outdoor banks can be made up easily out of a number of equipments similar to the 2520-kva equipment shown (houses 168 separate 15-kva capacitor units).

Here's why: The distance that *kilowatts* can be transmitted *economically* to remote loads has changed but little in the last few years, but a great reduction has taken place in the economic transmission distance for *kilovars*.

This reduction is a result of the greatly reduced cost of supplying kilovars near the load area by means of capacitors.

If it cost nothing to supply your kilovar requirements *at the load*, it would be uneconomical to transmit kilovars even as far as your first transformer, because of the system investment that is eaten up in transmitting them. The transmission of kilovars a great distance usually means larger transformers, copper, and other circuit elements. Then, too, the traveling kilovars cause I^2R losses, which drain off companion kilowatts before they reach the payload, as well as I^2X losses.

Naturally, even with capacitors, it still costs something to supply kilovars at the load. But the cost of "on-the-spot generation of kilovars" with capacitors has been reduced during the past 15 years to about one-quarter of the original figure. Hence, a general answer to the question "How far can you afford to transport kilovars?" is this: "Only one-quarter as far as you did 15 years ago." Consideration of this fact may help you meet the ever-present challenge to produce lower-cost power.

We will be glad to help you analyze your kilovar requirements and estimate the benefits of Pyranol capacitor banks on your system. Ask for Publication GEA-4225. *General Electric Company, Schenectady 5, N. Y.*

PYRANOL CAPACITORS

Buy all the BONDS you can—and *keep all you buy*

GENERAL ELECTRIC

407-87-5700

ELECTRICAL WEST

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Cover Photo: In Lockheed's new building, lighted by twin incandescent units. The platform for one of the substations can be seen above. Interior was painted a high reflection factor white to reverberate the light as much as possible. See story on page 66.

CHANGE OF ADDRESS

Circulation Manager,
Electrical West,
68 Post St.,
San Francisco 4, Calif.

Please change my address

From .....

To .....

Signed .....

People

J. L. Buckley
who describes PG and E's first 220-kv. carrier relaying installation on page 74, has been in electrical designing for that company for the past 25 years. Up to five years ago, he ran a squad in the drafting department. Since then he has worked on substation and power plant design in the department of hydroelectric and transmission engineering. His early electrical training received in a polytechnic school was supplemented by extension work at the University of California.

Homer Bender

has been Washington Water Power's expert on adequate wiring and with equal thoroughness has gone into the electric house heating situation and come out with a simple formula for determining its feasibility in any given area (p. 76.) He makes a valuable contribution to the progress of this type of load building, so much in the public eye now. He heads a NWEL&P Assn. committee on this subject, recently appointed.

Preview

Convention in Print

Once again a convention in print becomes the only kind of convention that can be held, this time because of war restrictions on travel and hotel accommodations. Yet again the inspiration and the stimulation of thought which comes from a convention of the entire industry will be found in the "program" of the convention in print in June's ELECTRICAL WEST.

Such highly important topics as employee relations will be discussed both by able spokesmen for management and for labor. Industrial developments resulting from the war, new appliance trends, lighting in all of its new techniques, wiring as the arterial system for it all—will be well presented by authorities in each field. Engineering and operating conversions from war to peace will find places of interest on the program as well.

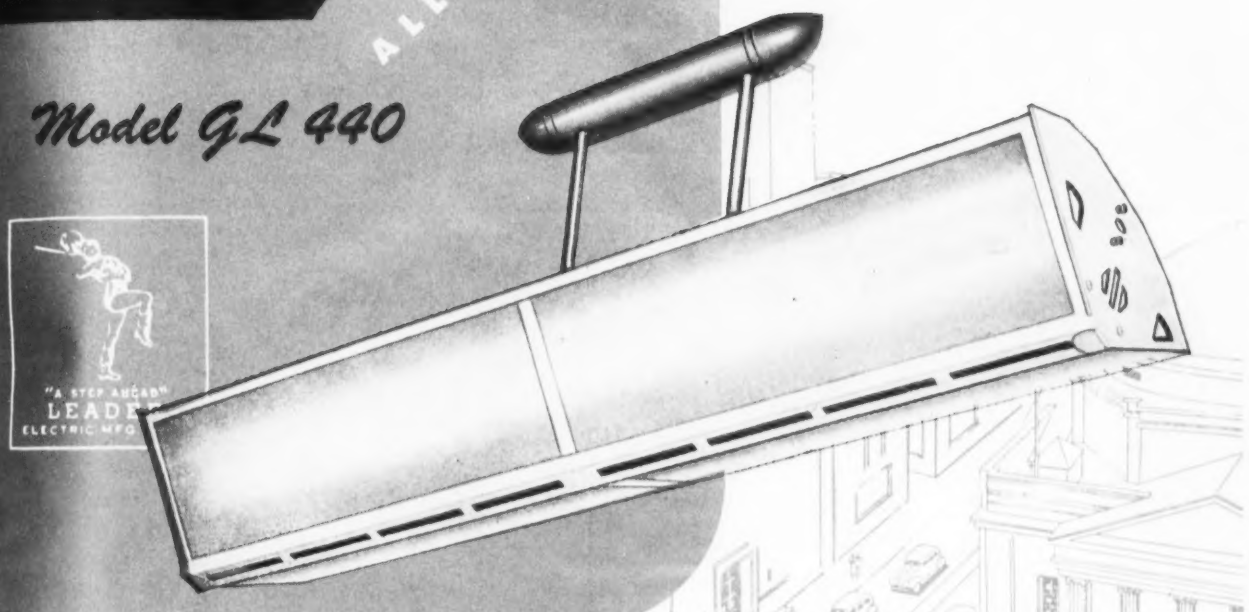
And of course there will be the news of the industry and other features.

Leader

ALL PURPOSE

COMMERCIAL FIXTURE

Model GL 440



a fluorescent fixture for *Main Street*

Designed for offices, stores, institutions . . . from Main Street to Broadway.

The Leader GL 440 is adaptable to a wide variety of installations, particularly, offices, drafting rooms, schools, stores, banks and other institutions.

A four light glass enclosed unit with a simple concise design, the Leader GL 440 lends itself to modern trends in architecture and lighting.

A hinged panel with snap fasteners is provided to facilitate relamping and servicing. Easy to install either in individual or in continuous run, flush mounted or hung from stems and canopies.

Distributed only through the better electrical wholesalers.

★ post war lighting *Now!*

There is a Leader representative in your area

Leader Electric Manufacturing Corp.

6127 North Broadway, Chicago 40, Illinois

West Coast Factory

2040 Livingston Street • Oakland 6, California

"No Experience Necessary"

That's a phrase we're borrowing from the "Help Wanted" columns, for it certainly applies to Bethlehem's new serving tool . . . a tool so easy to use that any lineman can learn to handle it in a few minutes' time.

As the illustration shows, the device makes possible a neat, tremendously strong serve by means of the dead-end coil method. Using a 10-foot coil of 11-gage bethanized dead-end wire, the lineman hooks one end in place on the strand; then, engaging the wire between the fingers of the serving tool, he wraps it solidly in place with a simple rotary motion. Exhaustive tests have proved conclusively that the serve holds beyond the useful strength of the strand.

After a little practice, the lineman can make his serve in about the time required to attach conventional clamps. Besides, this serve is considerably more economical than the clamp method, for a coil of the necessary wire costs less than even a single inexpensive clamp.

The serving-tool technique is especially recommended for use with *bethanized* strand and wire—manufactured by Bethlehem Steel Company. One reason is that the highly ductile, uniform bethanized coating (almost 100 per cent pure zinc, applied electrolytically) is not displaced to any harmful extent by the operation of the serving tool. Moreover, when bethanized strand and dead-end wire are used, there is no question about the holding power of the serve.

Write for more details—or, better still, ask the nearest Bethlehem representative to explain this simple, effective technique.

★ ★ BETHLEHEM STEEL ★ ★

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*

FOR satisfactory performance of duty under all conditions of service...even the most critical will approve this citation of rigid steel conduit.

Neat and orderly appearing! And for strength and endurance, rating is the highest. Dependability in emergencies, 100%.

When Youngstown Buckeye Conduit is "back from the war," you can again employ this veteran protector wherever you need to give your wiring jobs unfailing, enduring protection.

BUCKEYE TRADE MARK YOUNGSTOWN CONDUIT

Ask your distributor for:
Youngstown Buckeye Conduit ... Pipe and Tubular Products ... Sheets ... Plates ... Electrolytic Tin Plate ... Bars ... Rods ... Wire ... Nails ... Tie Plates and Spikes

YOUNGSTOWN
THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN, OHIO
Manufacturers of
CARBON · ALLOY AND YOLOY STEELS

RETAIL-MINDED
LOOK AHEAD WITH

KELVINATOR

Not just words... a business future!

"Retail-Minded Kelvinator" is more than a phrase . . .

It sums up the whole meaning of the Kelvinator franchise and the Kelvinator way of doing business.

It means a sounder way of business thinking . . . a better way of business life for the men who make up the finest retail organization in the appliance industry.

It means a future for those who become a part of this retail organization . . . a position of dignity and importance in their communities . . . and sounder business opportunity for the long pull *after* the first big years of the postwar boom are past.

The principle of "retail-minded thinking," on which the Kelvinator Franchise is based, has set new standards in business and human relations for this industry because its main premise is this: *Kelvinator feels that no sale is completed until the product leaves the retailer's floor.*

Every word, every thought in the Kelvinator Franchise is conditioned by this basic "retail-minded" concept. That is why the Kelvinator Franchise provides for . . .

A Limited Number of Dealers . . . with each dealer big enough to cover his market and each market adequate to insure a sound, highly profitable return . . . year in and year out . . . on his investment of time, money and effort. And the net result of this Kelvinator *selective* market and dealer policy is . . . *more sales per dealer.*

Retail-Minded Product Policies . . . a line of products so simplified and compact as to reduce retailer's investments in inventory to the lowest in the industry. This retail-minded policy enables Kelvinator Retailers to concentrate on high-unit-of-sale, volume products . . . with no slow-moving, low-volume models to raise inventory costs and cut turnover.

Competitive Prices . . . Kelvinator's aim will be to continue its competitive pricing policy with a proven step-up plan offering visible, salable features and values at each step . . . thus providing a much higher unit per sale.

Retail-Minded Merchandising . . . advertising, sales promotion and a full sales training program built from the retailer's point of view and designed to move products off the floor into the homes of users.

This is what "Retail-Minded Kelvinator" means . . . This is why Kelvinator Retailers know that the Kelvinator Franchise is the most valuable in the industry today!

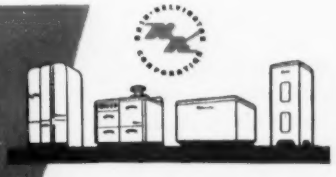
The most Valuable Franchise in the Appliance Industry

RETAIL-MINDED

Kelvinator

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha • Milwaukee • DETROIT • Grand Rapids • Lansing



Tune In

Every Sunday 4:30-5:00 P. M. EWT for the new NASH-KELVINATOR RADIO SHOW, starring the ANDREWS SISTERS—Over the entire Blue Network

CHROMALOX Gives More Contact Area

Cross section of INCONEL sheathed tube shows the exclusive CHROMALOX design which gives maximum cooking contact area.

These famous CHROMALOX Tubulars are the result of 25 years continuous research and engineering in the field of electric heat under rigidly maintained standards of excellence.

★ **Speed!** Electrical Testing Laboratories prove it. Housewives acclaim it—faster than you thought possible.

★ **Long Life!** Made of INCONEL—the finest heat resisting alloy known—which guarantees long trouble-free life.

★ **Easy Cleaning!** CHROMALOX reflector lifts out. It's washed as easily as a china dish.

★ **Economy!** The large flat cooking surface, that *stays* flat, provides greatest possible cooking efficiency.

These famous CHROMALOX Tubulars will be available just as soon as their vital materials are released from war work. CHROMALOX *Super-Speed* and *Heatflo* now available for all ranges.

EDWIN L. WIEGAND CO.
7540 Thomas Blvd., Pittsburgh 8, Pa.

Montgomery Bros., 420 S. San Pedro St., Los Angeles, Calif.; 2333 N.W. Westover St., Portland 10, Oregon; 61 Fremont St., San Francisco 5, Calif.; 911 Western Ave., Seattle 4, Wash.
The Peterson Co., 1921 Blake St., Denver 2, Colorado

on new ranges and for replacements

CHROMALOX

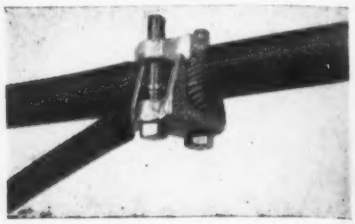
means *"Electric Cooking at its Best!"*

RC-4

PRODUCTS *that are news*

Connector (500)

W. N. Matthews Corp. has developed a new connector for copper or aluminum wires from 2/0 to 1,000 MCM inclusive. These "Uniclamp" connectors will accommodate two conductors of their rated size or one conductor of their rated size with one or more smaller tap-off wires, down to No. 8 solid. They are said to be so assembled that the parts cannot become separated and to be, in effect, a one-piece conductor. According to the manufacturer they can be securely tightened with a six or eight-inch wrench and have a locking effect which prevents their becoming loosened.



Panel Instruments (501)

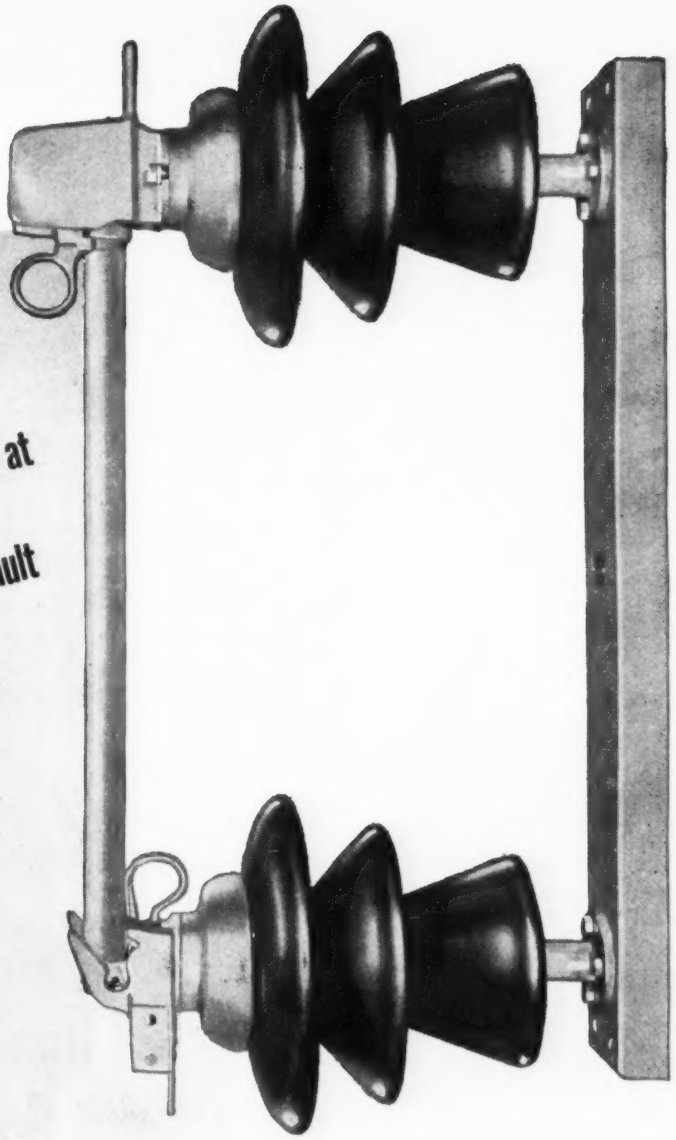
General Electric has a new line of 1½-in. electric indicating panel instruments. Two forms are available: One is a watertight design for application where the equipment may be accidentally submerged in water, exposed to rain or used in extremely humid climate; the other is a conventional design for use in aircraft or in other service where the instrument will be protected from the elements. The watertight instruments are designated as types DN-1, DN-2 and DN-3 and the conventional instruments are types DN-4, DN-5 and DN-6. Both have the same basic design, utilizing an internal-pivot element combined with the permanent-magnet moving-coil construction.

Induction Heating Table (502)

Induction Heating Corp is making a single-position, induction-heating work table. The table is equipped with a standard thermonic output transformer mounted to effect interchangeability from one type transformer to another. The table bench includes a sink for use in spray quenching operations. The control circuit has two timers, one for controlling the quenching period and the other for controlling the delay period from the end of the heating cycle to the start of the quench cycle. Start and stop control buttons are mounted on the front of the table.

Rectifier Tube (503)

Taylor Tubes Inc. has a high-vacuum, half-wave rectifier tube in production. The new tube bears the number TR-40M and is 9⅞ in. high with a maximum diameter of 3 13/32 in. It has a four-pin jumbo (50-watt) base and a thoriated tungsten filament. Plate lead is at the top and filament leads are brought out to pins No. 2 and 4. Filament power is 5.0 volts at 10.5 amp.; peak forward volts, 25,000; peak inverse volts, 60,000; average plate current, .25 amp.



Here is another Westinghouse "exclusive"

. . . the double circuit protection provided by DBA fuses with "De-ion" and drop-out action at every rating from 7.5 to 138 kv. Complete fault interruption before drop-out eliminates arcing and burned contacts. Fault is isolated from feeders by 180° air break . . . replacements are easily spotted.

And furthermore . . .

no metallic parts or combustible gases are discharged from the fuse . . . only water vapor. Interrupting ratings are high . . . the DBA-1 fuse has 50/60 cycle interrupting rating from 10,000 amperes at 7500 volts to 4000 amperes at 69,000 volts; the DBA-2 from 15,000 amperes at 46,000 volts to 7,000 amperes at 138,000 volts.

The DBA Boric Acid fuse is easy to service . . . simple hookstick operation and self-aligning hinges make replacement a matter of seconds. Drop-out action is weather-protected against ice and snow. Ask your Westinghouse office for full information on this safer, more efficient, easily-operated DBA fuse. Ask for bulletin B-3419. Westinghouse Electric & Mfg. Co., P.O. Box 868, Pittsburgh 30, Pa. J-60577

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

DBA DROPOUT BORIC ACID FUSES

"Imagine! She's First in Line for a NEW BENDIX!"

D'ye ever hear of a woman being *envied* because she was first in line to buy an electric "washer"?

No, you never did! *But it's true now!* Thousands of women are congratulating themselves—because they've registered for one of the first new Bendix Automatic Home Laundrys available.

They even consider themselves lucky to be one of the *first half million!* And why not?

They'll get the *only* completely home-tested and proved "automatic"—that washes, rinses and damp-dries at the click of a switch.

The *only* "automatic" that's hailed and championed by three hundred thousand enthusiastic owners.

The *only* "automatic" that's proved and acclaimed by eight years of satisfying owner-experience. And they'll get it as quickly as they could obtain a second choice which might be less satisfying.

That's why the dealer who had the gumption to see through his buyer's eyes—has been quick to identify himself as the merchant who'll sell the one-and-only Bendix Automatic Home Laundry.

BENDIX automatic Home Laundry

Bendix Home Appliances, Inc., South Bend, Indiana...Pioneers and Perfectors of the Automatic "Washer"

Water is a SABOTEUR

Ever since the first insulated cables were made water has been the arch-enemy of dependable operation. Before the war Simplex developed and produced Simplex-ANHYDREX deproteinized rubber insulation. Now Simplex has developed a new ANHYDREX insulation made from specially treated and compounded Buna rubber.

This new ANHYDREX insulation has a water absorption rate of only 20 milligrams per square inch of exposed surface. That is far ahead of anything that was dreamed of a few years ago with synthetic rubber.

If you have a submarine cable or an underground power cable problem, let the Simplex Sales Engineers show you how ANHYDREX rubber insulation can save money and make a more satisfactory installation for you

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex WIRES and CABLES

SYLVANIA NEWS
CENTRAL STATION EDITION

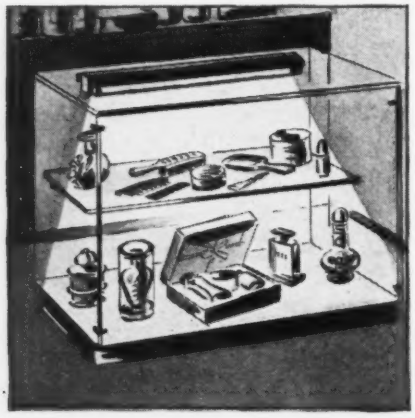
MAY *Published by* SYLVANIA ELECTRIC PRODUCTS INC., Salem, Mass. 1945

WIDER FLUORESCENT USE IN 21-INCH LAMP

New-Size Lamp Fits Into Small Spaces

Public utilities, particularly those active in educating the consumer to modern lighting possibilities, will be interested in the applications provided by Sylvania Electric's new 21", slim fluorescent lamp.

Showcase illumination, for example, has always presented difficulties. First, relatively high levels of light within the case are desirable, and the space into which the source must fit should be kept as small as possible. Then there are problems of odd case lengths where the standard T-8 lamps will not fit, leaving



consequent gaps in the lighting. Also, efficiency demands a reflector of a size that does not fit closely around the lamp.

Five-eighths of an inch in diameter, this latest addition to Sylvania's miniature fluorescent line should be recommended for use in window displays and showcases, where a minimum of obstruction to the line of vision is necessary. Further possibilities for using the new lamp are in stair landings, doorways, ticket windows and the bathrooms and kitchens of homes. Although of the slim type, the lamp uses a standard FA-3 miniature bi-pin base and an FS-4 starter.

NEW POSITION INDICATOR ANOTHER SYLVANIA FIRST

Plastic Base Fluorescents Have Added Over-the-Counter Appeal

Representing another major advance in the modern lighting field, position indicators—molded into the new plastic base of Sylvania Electric fluorescent lamps—offer an exclusive feature that will boost over-the-counter sales. When the lamp is correctly inserted in the lamp-holder, an indicator, placed on the shoulder of the cap at right angles to the pins, points down. The touch of a finger is the only check required for positioning.

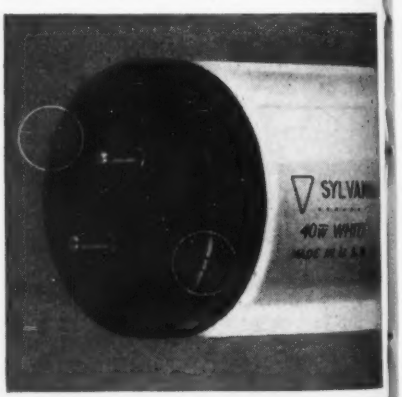
Since these new lamps can be installed more easily, replacement of dead lamps can be made more quickly—obviously helping to maintain connected load.

Besides, this sure method of checking lamp installation by position indicators will mean fewer lamps coming loose or falling from their holders. Servicing of installations will be simplified—a factor of great importance.

In addition, the new plastic base is unaffected by normal conditions of excessive moisture or acid vapor in the air. A stronger, ribbed interior construction of the cap lessens the chance of a loose base or pushed-in pins.

THE OLD WAY: *A final squint was needed to be sure lamp was correctly positioned.*

THE NEW WAY: *Position indicator instantly verifies correct mounting.*



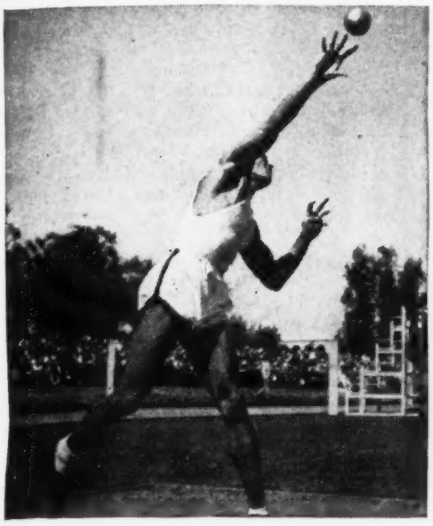
Here is the new plastic base, moisture- and vapor-resistant, with position indicators.

SYLVANIA ELECTRIC

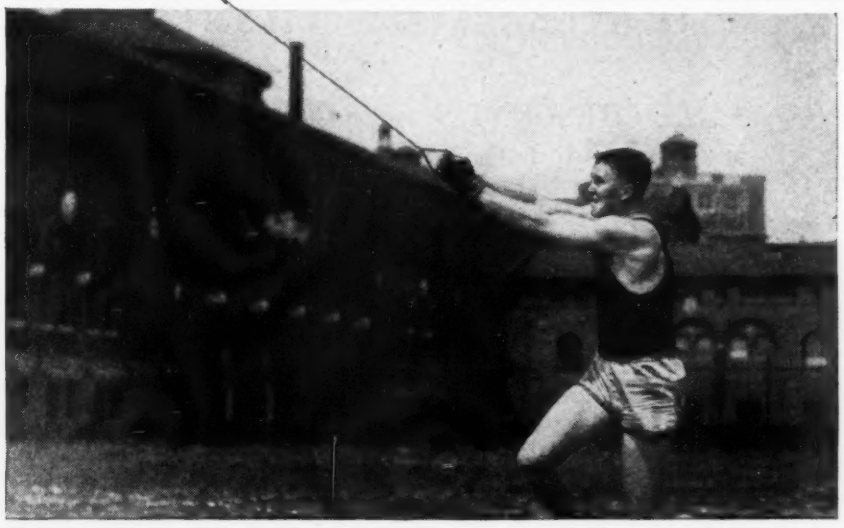
MAKERS OF FLUORESCENT LAMPS, FIXTURES, ACCESSORIES; INCANDESCENT LAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

The "Quick-Break" Principle

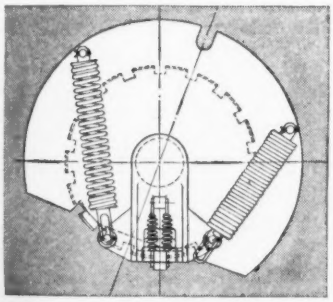
— IT'S TYPICAL OF THE ADVANCED PRINCIPLES USED IN ALLIS-CHALMERS 5/8% STEP REGULATORS



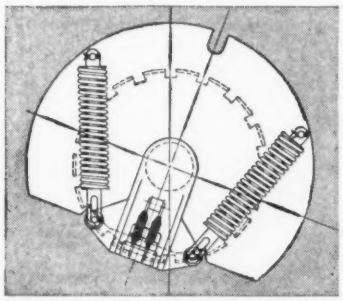
1 SLOW-BREAK action is demonstrated by the shotput, in which energy is applied as it is generated . . . not stored up in advance.



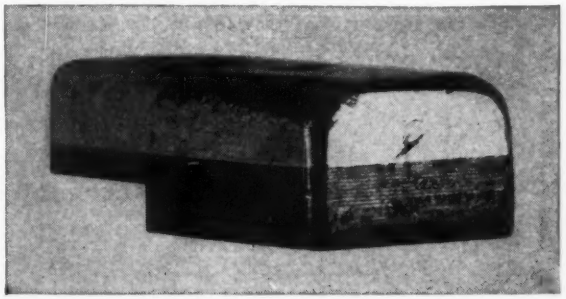
2 QUICK-BREAK action, as illustrated by the hammer-throw, is the result of building up energy for sudden release. Application of the quick-break principle to the Allis-Chalmers tap-changing mechanism results in *longer contact life*, since arcing time is shortened . . . burning and pitting avoided.



3 COCKED by tension on left-hand driving spring, the mechanism in above position is about to make a tap change.



4 RELEASED, the crank arm operates tap-changer switch and is snubbed to stop by springs *without shock to mechanism.*



5 MOVING CONTACT is still in good operating condition after equivalent of 50 years in normal service. Fast contact separation and large contact size both contribute to long life.

6 OTHER PRINCIPLES:

- All moving parts on Allis-Chalmers 5/8% Step Regulators are oil-immersed . . . remain dust-free and need no lubrication.
- Feather-touch control, coupled with voltage integration, fits regulator to handle wide variation in load conditions.
- Unit construction, with transformer and tap-changing mechanism suspended from cover, eliminates 78 bolted connections.

Write for Bulletin B6056A, ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WISCONSIN

A 1794

Whatever the Voltage-there are

Allis-Chalmers

5/8% Step Regulators

that will do the job better and at Lower Cost.

• RUBBER POWER CABLES • VARNISHED CAMBRIC CABLES •

CRESCENT SERVICE CABLES

Employ

Heat Resisting Insulation

• ***ALL*** **CRESCENT Service Cable is insulated with a Type RH, super-aging, heat-resisting rubber compound of the best grade obtainable that gives *35 to 44% greater current carrying capacity* than ordinary code grade insulated service cable.***

• **Service cable is the bottleneck limiting the amount of customer demand for all appliances, and future business for the contractors, dealers, wholesalers and power suppliers.**

• **With CRESCENT SERVICE CABLE you get maximum load capacity, long life and value. Made in Type SE, Style U, as shown; Style A with a galvanized steel armor tape over the bare neutral conductor, and in type SD, Drop Cable. Sizes—No. 12 to No. 2 AWG in two and three conductors.**

* Based on 1940 N.E. Code.

Available through
Electrical Wholesalers

CRESCENT
WIRE AND CABLE

NEMA

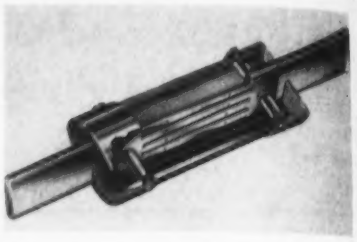
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

• IMPERIAL NEOPRENE JACKETED PORTABLE CABLES •

• BUILDING WIRE • SERVICE ENTRANCE CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE • ARMORED CABLE •

• PERMACORD • LEAD-ENCASED AND PARKWAY CABLES • SYNTHOL WIRES • WELDING CABLES • SHIPBOARD CABLES •

Cartridge Fuse (504)



Royal Electric Co. has redesigned its non-renewable cartridge fuse, above, to incorporate a "grid" link, which replaces four single links and cuts solder connections to the blades from eight to two. A metal crossbar is used to position the link and blade, which are anchored into the complete assembly by a stud riveted through the ferrule and casing into the crossbar.

Aircraft Transformers (505)

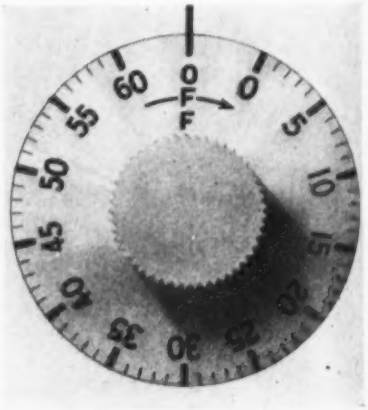
General Electric Co. has designed two new 115-volt, 400-cycle, single-phase transformers for operation of 6-volt aircraft instrument lights. These transformers have an output capacity of 30 va. and either permits simultaneous operation of 25 lamps at full brilliancy. One is equipped with taps to facilitate preselection of any desired light level within the units range of 6 to 1.74 volts. The other unit has no taps but desired light level can be maintained by use of a potentiometer.

Tandem Generators (506)

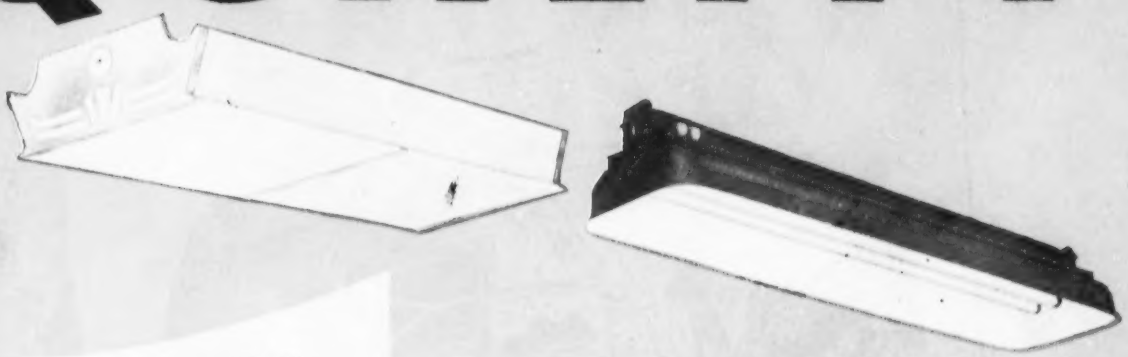
Induction Heating Corp. has announced that it is now using a coaxial equalizer to couple two standard thermonic induction generators to secure full output of both from a single set of terminals. Since each of the company's model 1070 generators has an output of 1,070 Btu per minute, full 40-kw. power is available for use in any desired application with a single control station operating the tandem generator set-up, the manufacturer states. The 20-kw. generators also can be operated separately.

Electric Range Timer (507)

Warren Telechron Co. will offer an electric timer for range installation, which it states is the forerunner of a complete line of range timers powered by 2-watt synchronous motors designed for operation on regulated alternating current. It can be furnished for 115 or 230 volts and any standard commercial frequency. Samples of the new model, E-10, will be off the production line July 1, the manufacturer states.



Build your lighting business with MITCHELL QUALITY



Play Safe with Your POST-WAR FUTURE . . . Depend on MITCHELL for all this!

A complete line of lighting units—new ideas—advanced designs—best sellers—volume repeaters. The right kind of unit for every purpose: factories, offices, stores, schools, homes, public buildings. Easier to sell! Surer to satisfy!

Industrial and Commercial Units
Fluorescent Desk Lamps
Strip Lighting
Slimline and Circline Units
I. E. S. Floor and Table Lamps
Fluorescent Kitchen Units
Bed Lamps
Infra-Red and Ultra-Violet Health Lamps
Lullaby and Lumitone Radio Lamps
Polaroid Lamps
Spotlight Equipment
Store Window and Show Case Lighting
Store Counter Units
and Other Lighting Specialties

TOP QUALITY . . . based on *sound engineering* . . . distinguishes every MITCHELL creation. Yesterday you found many design and construction features, exclusive with MITCHELL, a proved stimulant to sales. Tomorrow . . . MITCHELL ingenuity and resources will bring you a guaranteed quality line that insures utmost beauty, utility, performance. A complete and completely *certified* line that will enable you to render a thorough lighting service to your customers.

MITCHELL
FIRST IN POPULARITY

Mitchell Manufacturing Company
2525 CLYBOURN AVENUE, CHICAGO 14, ILLINOIS
West Coast Factory and Sales Office: 1019 N. Madison Ave., Los Angeles 27, Cal.

a little fantasy explains A LARGE FACT

"Maybe it will look right if I stand on my head," said Alice
Alice couldn't seem to understand.
The Mock Turtle sighed deeply, drew one flipper across his eyes, and began again.
"This line is the cost of living going up—and that line is the cost of electricity coming down. Now do you see?"
"No," said Alice, doubtfully, "why don't they go together? One of them must be upside down."
Sobs suddenly choked the Mock Turtle.
Alice was eager to please. "Maybe it will look right," she said, "if I stand on my head!"
☆ ☆ ☆
There is an Alice-in-Wonderland flavor to the simple facts about electricity.
The average price of household electricity has actually come DOWN since war began—while the cost of most other things was going UP.
There has been no shortage of electricity—the basic raw material of all war production—though most other important war materials have necessarily been scarce or rationed.
That record is the result of careful planning and hard work by America's business-managed electric companies. And it is your assurance of plenty of cheap electricity for peacetime job production—and for all the new electric conveniences you'll enjoy after the war.
Hear NELSON EDDY in "THE ELECTRIC HOUR"—with Robert Armbruster's Orchestra—Sunday afternoons, 4:30 EWT, CBS Network.
It's up to the U. S. Bureau of Labor Statistics.
167 ELECTRIC LIGHT AND POWER COMPANIES
SELF-SUPPORTING, TAX-PAYING BUSINESSES
DON'T WASTE ELECTRICITY JUST BECAUSE IT'S CHEAP
★ Names on request from this magazine.

UPSIDE-DOWN Alice, in the advertisement shown here, illustrates one of the most startling facts in today's wartime living — that —

While the cost of most other things has gone UP, the average price of household electricity actually has come DOWN.

This advertisement appears in national magazines during May. It is another in the co-operative series reporting the record — past and present — of America's *business*-managed electric companies.

Similar advertising in magazines, farm publications and newspapers is backed by an entertaining and popular radio program — "The Electric Hour," featuring Nelson Eddy — every Sunday afternoon (4:30, EWT) over CBS.

Listen to "The Electric Hour" regularly, watch for the advertisements as they appear, and tell your friends about them. The whole program is doing a job for *your industry—your company—and YOU.*

167 ELECTRIC LIGHT AND POWER COMPANIES★

SELF-SUPPORTING, TAX-PAYING BUSINESSES

★ *Names on request from this magazine.*

PROTECT THE WIRING YOU INSTALL WITH G-E FUSES

Here are fuses worthy of your finest wiring installation. Your customers know that the General Electric monogram stands for high quality. G-E fuses will be in keeping with your good workmanship . . . will add further proof of the quality of your work. These fuses are made of the best materials and are thoroughly tested and accurately rated.

G-E Non-renewable Enclosed Fuses 1-600 Amp., 250 V. or 600 V. Both indicating and non-indicating types are available.

G-E Renewable Enclosed Fuses 3-600 Amp., 250 V. or 600 V. Fiber bar supports link, provides proper alignment of terminals and facilitates replacement.

G-E Silvend Fuses with silver-plated contacts 3-600 Amp., 250 V. or 600 V. Designed for use with apparatus having silver-plated fuse contacts. Heating due to oxidation does not occur with this combination.

G-E Pyrex Plug Fuses 3-30 Amp., 125 V. Neat appearing. Magnifying windows make reading easy.

The G-E Fuse line is large. It contains fuses for use with all types of wiring installations. These are the same fuses that General Electric uses to protect its own wiring and equipment.

FOR FURTHER INFORMATION on G-E fuses or conduits or building wires, see the nearest G-E Merchandise Distributor or write to Section CDW553-18, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

BUY WAR BONDS AND KEEP THEM

FOR COMPLETE ENJOYMENT
A. C. Rogerson, electrical contractor, Detroit, Mich., says, "It is a duty of all connected with the electrical industry to make sure that the people who plan post-war homes know that adequate wiring is imperative to the complete enjoyment and full use of electrical servants."
ADEQUATE WIRING
THE KEY TO THE HOME OF TOMORROW
SERVES AND SAVES

G-E CONDUIT AND BUILDING WIRE

There are conduits and building wire in the G-E line for every purpose: G-E White zinc-coated rigid conduit, G-E Black enamel-coated rigid conduit, EMT, flexible metal conduit, Fiberduct; and Flamenol small diameter building wire Types SN and SNW and building wire Types R, RH and RW.

GENERAL ELECTRIC

Hear the G-E radio programs: "The G-E All-Girl Orchestra" Sunday 10 p.m. EWT, NBC; "The World Today" news, Monday through Friday 6:45 p.m. EWT, CBS; "The G-E House Party" Monday through Friday 4:00 p.m. EWT, CBS.

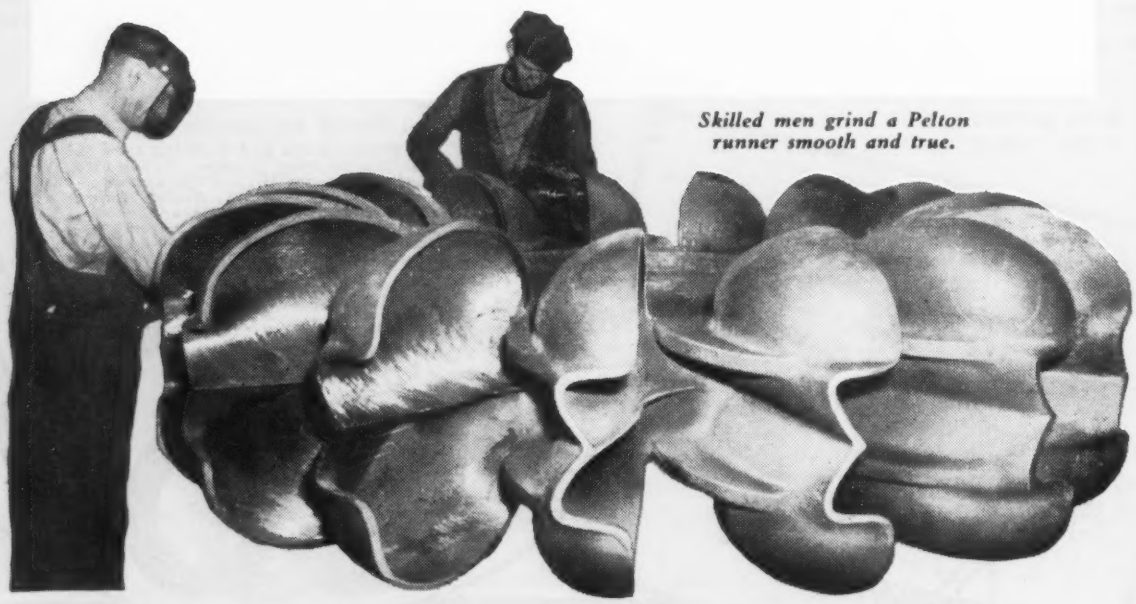
65 years of Turbine Construction

HYDRO-ELECTRIC TURBINES were pioneered in the far-West where there was an abundance of falling water.

It was Lester A. Pelton, a mining engineer, who built an improved turbine with central-dividing splitters incorporated in the buckets. His design was immediately selected by the electric companies as being far more efficient and far more reliable.

World-wide acceptance followed.

Today, Pelton Turbines and their water-control accessories are designed with 65 years of cumulative knowledge that is still the unsurpassed standard of reliability and perfection for helping utilities offer lower electric rates to homes, industries and farms.



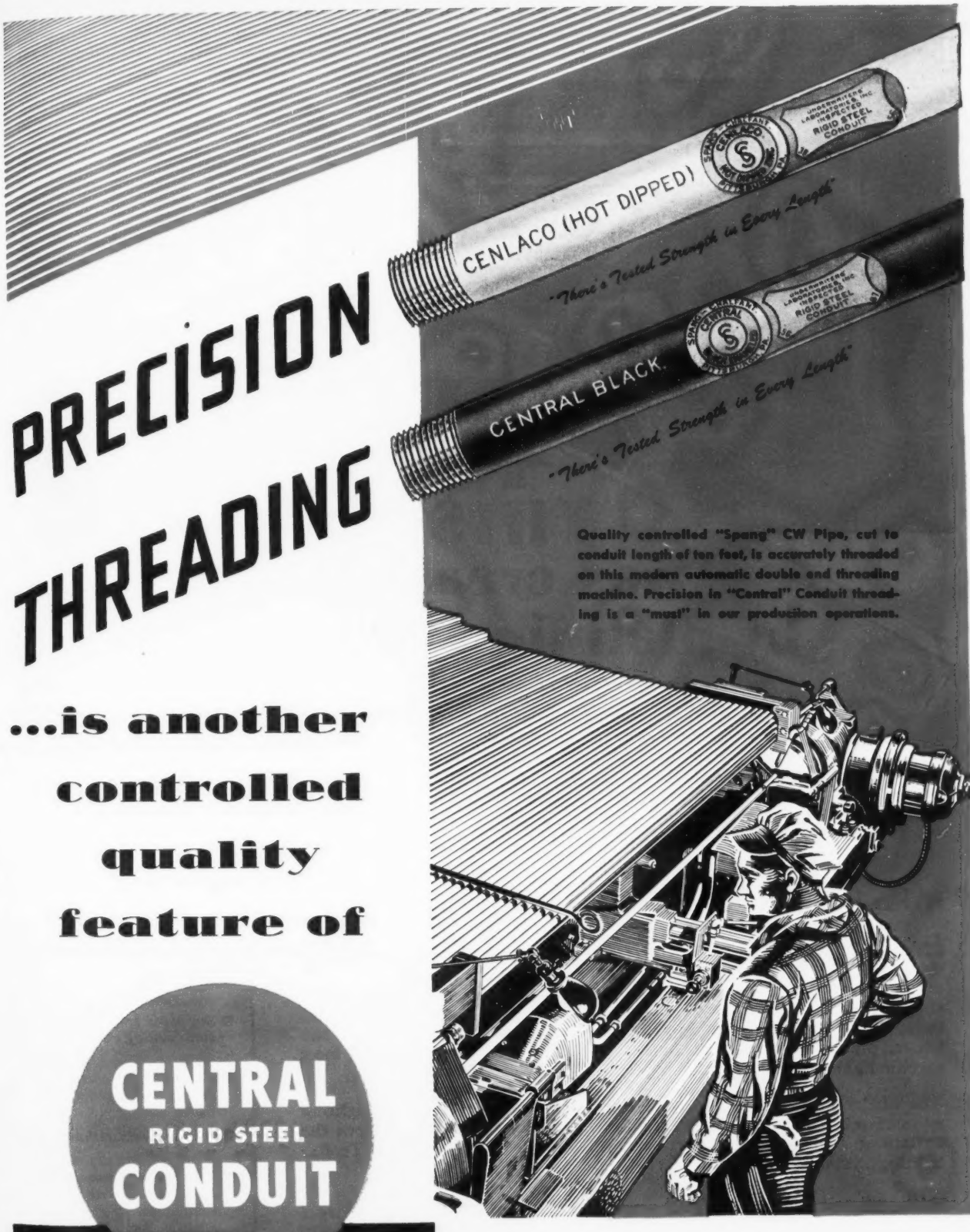
Skilled men grind a Pelton runner smooth and true.

The PELTON WATER WHEEL Company

A Subsidiary of the Baldwin Locomotive Works

2929 NINETEENTH STREET • SAN FRANCISCO 10, CALIF.

BLW THE BALDWIN GROUP


CENLACO (HOT DIPPED)
"There's Tested Strength in Every Length"
RIGID STEEL CONDUIT
CENTRAL BLACK
"There's Tested Strength in Every Length"
RIGID STEEL CONDUIT
Quality controlled "Spang" CW Pipe, cut to conduit length of ten feet, is accurately threaded on this modern automatic double end threading machine. Precision in "Central" Conduit threading is a "must" in our production operations.

PRECISION THREADING

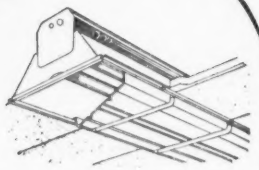
...is another controlled quality feature of

CENTRAL
RIGID STEEL
CONDUIT

SPANG-CHALFANT

Division of The National Supply Company
General Sales Office: Grant Building, Pittsburgh 30, Pa.
District Offices and Sales Representatives in Principal Cities

THIS was created by planning around THIS Lighting



This beautiful — and practicable — interior grew from the lighting.

It grew *easily*, because versatile Miller Fluorescent Troffer lighting systems are engineered to simplify planning and to simplify construction. It grew *beautiful*, because Miller Fluorescent Troffer lighting systems are esthetically sound. It grew *useful*, because they are one of the outstanding lighting achievements of our time.

MILLER FLUORESCENT TROFFER LIGHTING SYSTEMS

for stores, schools, offices, factories and public buildings

are readily installed as single units, blocks, geometric patterns or lightstrips "by the mile." They harmonize with interiors and even suggest themes for the entire building. There is a wide choice of glass or plastic lenses, plates, and metal or plastic grilles. A choice designed to meet specific lighting requirements.

The Miller patented bracket ends laborious fitting of recessed lighting systems into hung ceilings. Now, these brackets are mounted from the structural ceiling and support *both* the hung ceiling and the Troffer lighting system.

Miller distributors and field engineers are conveniently located to serve you.

OTHER MILLER TROFFER FEATURES:

- *Supports from structural ceiling cut 50 to 75%.*
- *Conduit and conduit fitting costs reduced up to 80%.*
- *Wiring costs reduced up to 50%.*
- *Permanent operation and maintenance economies.*

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

The Secret is in the COMBINATION

"Aluminum wires surrounding steel wires—high electrical conductivity, resistance to corrosion, high strength and dependability. That's your power line, when the conductors are Alcoa A.C.S.R."

It may take a bit of explaining to convince a rural customer that the aluminum he knows so well as milker pails, portable tools and paint will also deliver electricity to him. But the character of Aluminum Cable Steel Reinforced is no secret to the men who build and operate power lines. They've been seeing these conductors ride safely through the storms of well over a quarter of a century.

To men who are now figuring on new lines or extensions to old ones, Alcoa offers engineering assistance. What help are you needing?

ALUMINUM COMPANY OF AMERICA,
2132 Gulf Building, Pittsburgh 19,
Pennsylvania.

ALCOA
ALUMINUM
REG. T.M.

ALCOA A-C-S-R
ALUMINUM CABLE STEEL REINFORCED

WHEN NOTHIN'S COOKIN'

REPLACE WITH TK

TK REPLACEMENT UNITS ARE AVAILABLE NOW TO FIT ANY ELECTRIC RANGE

When your customer—Mrs. Housewife—calls and says, "Supper's on the stove but nothin's cookin'"—it's time for you to replace the burned out unit with a TK replacement unit assuring long life, economy and trouble proof operation. Every TK replacement means a loyal friend for your firm.

MAIL COUPON NOW FOR NAME OF YOUR NEAREST DISTRIBUTOR

TUTTLE & KIFT INC.

1825 NORTH MONITOR AVENUE • CHICAGO 39, ILLINOIS

Gentlemen: please send me name and address of nearest TK distributor. No obligation.

FIRM NAME _____

ADDRESS _____ CITY _____

Test Set (508)

A new light weight portable testing unit for residential and commercial wiring has been announced by the Connecticut Telephone & Electric Division of Great American Industries Inc. Basically the instrument is for use in testing insulation between wires or from wires to ground for defects or failures, and the continuity of wires with audible positive answers at the point where the test is made. With a special indicator attachment, it can be used also to determine the polarity of wires, visually. It operates on a hand cranked generator, which develops 500 volts d-c., and is said to be regulated to give a uniform test regardless of cranking speed.

Relay (509)

R. W. Cramer Co. has added a motor operated time delay relay. Type MCR, which is available both for a-c and d-c operation. Designed originally for airborne transmitter equipment, the device is said to be adapted for a number of industrial applications. Over-all dimensions are approximately 2-9/16 in. wide, 3-3/16 in. long, 3-3/16 in. high. Weight without cover is approximately 1 lb. 2 oz. These timers are available for 6 through 30 volts d-c and can be supplied with standard synchronous motor for either 110 or 220 volts, 50 or 60 cycles.

Crack Detector (510)

A photoelectric crack detector for inspection of glass jars and bottles has been developed by General Electric Co. in collaboration with Hartford-Empire Co. Jars and bottles pass on a rotary turntable and the detector automatically singles out and rejects those with defects. According to the manufacturer's announcement, the device inspects bottles as fast as they are made on a bottle machine and will detect even those flaws which are barely visible to the naked eye.

Lamp Name Changed (511)

To more properly identify the lamp, Westinghouse has changed the name of its 250-watt, R-40 bulb reflector type lamp from "reflector drying" to "reflector-infrared", according to recent announcement. The former designation, the company stated, often was taken to mean that the lamp was suitable only for drying purposes and would not serve satisfactorily for other applications of infrared or radiant heat.

Your community's interests may lie in this direction

Civic officials all over America are interested in ideas for presenting their home town boys with a memorial.

Yet, this time they prefer one that is practical, and one that is a sentinel for saving lives. These officials and leaders of civic groups should be given complete information on the benefits of good street lighting. For more information send to Westinghouse Electric & Manufacturing Company, P.O. Box 868, Pittsburgh 30, Pa. J-04027

World War I memorial.

Make Your Memorial Shout "FREEDOM"!

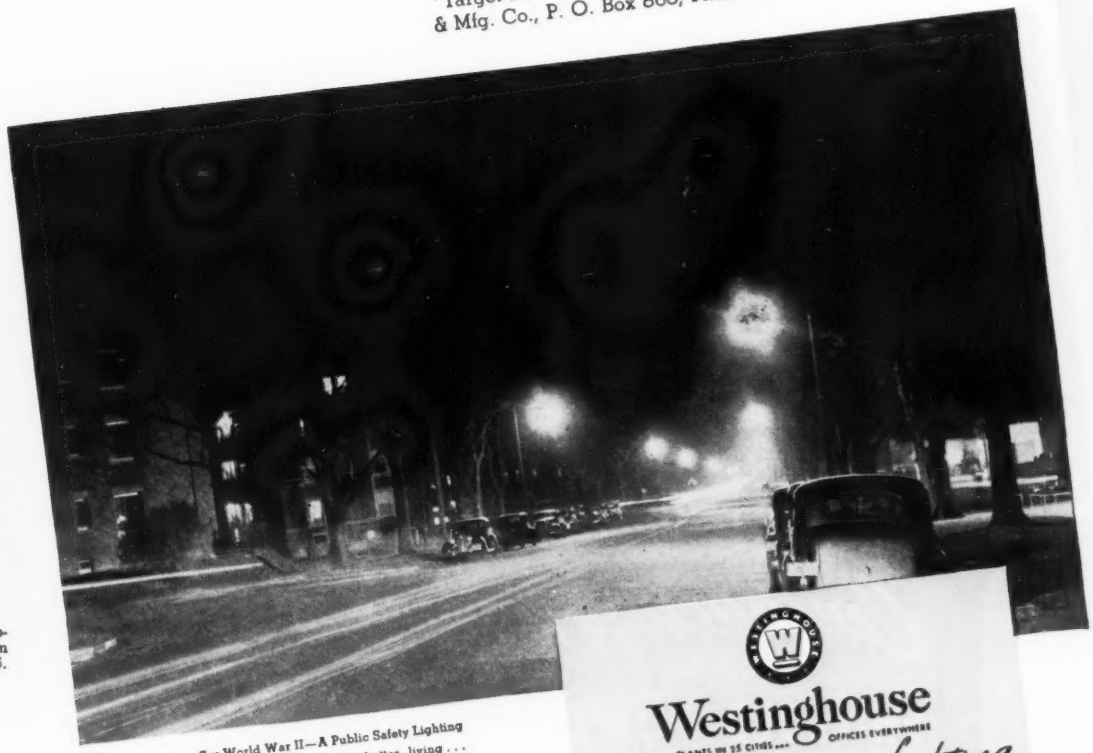
In your hands is the goal every GI is fighting for—his own home town! He wants it as he remembers it, yet progressive and improved.

You can give it to him that way, in a memorial that honors him and benefits the loved ones he fought for—in a Public Safety Lighting System. This memorial will honor him 365 days a year, and it will help his family and friends in a way he would want. It will help to free them from crime, burglaries, robberies, traffic disasters. It will be a big step toward the fuller life he seeks for them.

This memorial is one which will live as the mark of a good administration, which wipes out the darkness to control delinquency and disorder.

Many civic officials are studying this project with the help of Westinghouse street lighting engineers, who have lifetimes of experience in this work. These engineers bring information from other municipalities, which shows the need and pictures the results.

Good public safety lighting is fully described in a new book which contains facts helpful to civic leaders. Ask your electric power company for your free copy of "Target for Tonight" or write to Westinghouse Electric & Mfg. Co., P. O. Box 868, Pittsburgh 30, Pa. J-04030



For World War II—A Public Safety Lighting System will memorialize better living . . . safety for the individual . . . the end of brutalities that flourish in the darkness. It will symbolize an enlightened world, an end to blackouts forever.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Public Safety Lighting

This advertisement appeared in American City for April, 1945.

No, it isn't lead, it's CONDUCTING

Conducting rubber replaces lead on this new power cable for underground service and results in greater flexibility, lighter weight, easier splicing, greater resistance to electrolysis and corona effects. It is less affected by heat and withstands the effects of water, acids, alkalis and oxidation.

AMERICAN STEEL & WIRE COMPANY
USS STEEL
UNITED STATES STEEL

U·S·S AMERICAN
Conducting Rubber
SHIELDED POWER CABLE

covered with RUBBER

New Power Cable for underground work has many advantages superior to lead

War Production Board Directive

"No producer of copper wire mill products can use lead as a protective sheath in the manufacture of insulating wire and cable except for the following types: fire alarm and traffic control, telephone and telegraph, railway signal, switchboard cable and wire and cable rated more than 2,000 volts."

• • •

SINCE lead can no longer be used for underground power lines rated below 2,000 volts, American Steel & Wire Company engineers have developed a new power cable sheathed in conducting rubber.

Lead was formerly used because of its resistance to water, acids, alkalis and oxidation. It also acted as an electrical ground and shield.

The new type conducting rubber-covered cable has all these advantages and some others, too. It is more resistant to electrolysis, more flexible than lead, lighter in weight, easier to splice, does not buckle or wrinkle and has greater resistance to vibration and fatigue. In addition, it has all the advantages of our PS Shielded Cable which include intimate contact with insulation, elimination of voids and attendant ionization. Like our PS Shielded Cable, it is eminently suited for all operating voltages.

This new cable is *not* a makeshift to be used only while lead is scarce, but it is believed that its many obvious advantages will make it technically preferred by engineers. Write for additional information.

OTHER U·S·S AMERICAN ELECTRIC WIRE & CABLE PRODUCTS

AMPYROL — Synthetic-insulated wire and cable for switchboards and machine tools.

AMERCLAD — Tough abrasion resisting cable for portable tools, motor leads, power cable.

AMERBESTOS — Asbestos-insulated wire and cable.

AMERDUCTOR — Copper and steel conductor for low-cost rural lines.

American Steel & Wire Company

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

LOCATE radio dispatching stations for top performance

G-E remote-control multiplies system effectiveness

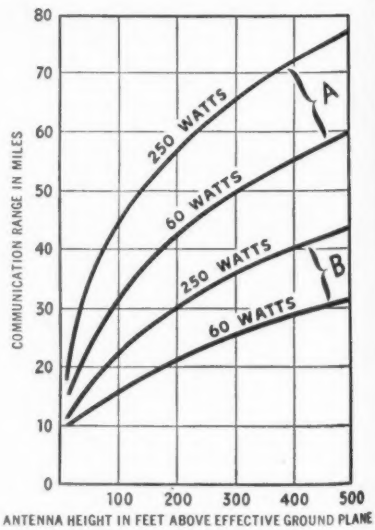
AN antenna placed at a carefully chosen low-noise-level location will pay big dividends in terms of increased 2-way radio coverage.

• A G-E remote-control unit enables you to take advantage of this simple and economical way to multiply the effectiveness of your radio system. This unit is designed to provide complete 2-way control of a remotely located transmitter and receiver by means of a simple two-wire line—at distances up to several miles. Thus, you can locate your radio station for maximum coverage—and your radio dispatcher can supervise his maintenance crews throughout your service area directly from his present service headquarters.

• Call your G-E sales engineer for information on the complete line of G-E 2-way FM communication equipment. Or write *Electronics Department, General Electric, Schenectady 5, New York.*

Government regulations now permit new installations of 2-way FM radio for important requirements of utility companies. Your G-E representative will help prepare your application.

Hear the G-E radio programs: *"The World Today" news, Monday through Friday, 6:45 p. m., EWT, CBS. "The G-E All-Girl Orchestra," Sunday 10 p. m., EWT, NBC. "The G-E House Party," Monday through Friday, 4 p. m., EWT, CBS.*



Effect of antenna height and location on communication ranges.

A applies to quiet residential and rural areas.
B applies to high noise-level locations, such as congested or industrial areas.
These curves are for estimating purposes only.

Everything for 2-Way Radio Communication

GENERAL ELECTRIC

163-D10-6918

SAMSON UNITED COULD SUPPLY MORE THAN 350,000 A MONTH

The Avenger Torpedo Bomber is playing a vital role in the successful operations of our naval task forces.

Samson United is proud to be building a very important part of this plane—the highly complicated power Turret. In so doing, Samson has not only met the strict specifications of a critical customer . . . the United States Navy . . . but for nearly three years has reached or exceeded production quotas.

The tremendous output of just this one war item is ample proof that Samson could, if required, supply more than 350,000 Automatic Heating Pads each month . . . pads that include such patented features as 3 FIXED HEATS with 4 Safety Controls on each heat.

As soon as Uncle Sam gives the green light to volume peacetime manufacture, SAMSON patented-method Heating Pads will be produced in quantities sufficient to meet the needs of those who look to you for quality electrical appliances. And they will be even finer in construction and operation because of the extra knowledge gained from precision wartime work.

SAMSON UNITED CORPORATION, ROCHESTER 10, N.Y.– SAMSON UNITED OF CANADA, LIMITED, TORONTO

THE POST-WAR PUBLIC
WILL DEMAND MORE QUALITY THAN EVER

E-WAR
ODEL
57P

FIRST, the public will have more money.

SECOND, war has educated the public to a higher appreciation of *quality* — since "the best" has been the constant byword in every phase of war production.

Monarch's post-war Line of Electric Ranges will fit right into this picture. Typical example will be Monarch's exclusive Roaster Range offering tomorrow's quality-conscious housewife cooking conveniences and advantages that go beyond the conventional.

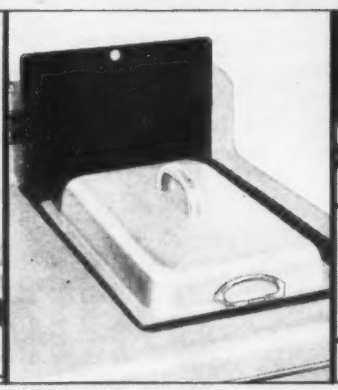
The Monarch Line will be spark-plugged by many other exclusive features. It's not too early to investigate.

MALLEABLE IRON RANGE COMPANY
3264 Lake St. Beaver Dam, Wis.

IF IT'S A
ROASTER RANGE
IT'S A
Monarch
ELECTRIC
PATENTED

A complete oven dinner (roast, potatoes, and vegetables), can be prepared in this convenient built-in roaster compartment.

Small utensils may be used for preparing two or three foods at one time, like these casserole dishes.



High-domed roaster cover increases capacity for large roasting operations such as fowl or baked whole ham.

When not in use, the smooth top panel conceals roasting compartment and increases working space.

Where Heat, Flame, Oil, Moisture, Grease and Corrosive Vapors will be encountered — —

Use NATIONAL ELECTRIC ASBESTOS AND ASBESTOS-VARNISHED CAMBRIC WIRES AND CABLES

For temperatures higher than permissible limits for rubber, NE\on (thermoplastic) and varnished cambric insulations, we recommend National Electric asbestos, asbestos-varnished cambric and asbestos—NE\on (thermoplastic) insulated wires and cables. Complete engineering data and literature sent on request.

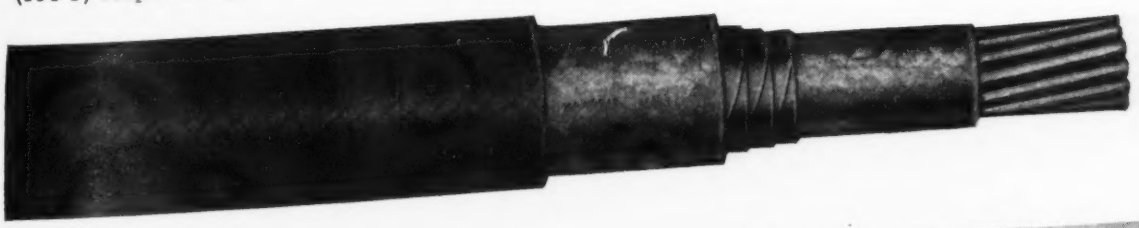
NATIONAL ELECTRIC PRODUCTS
NE
WIRING & SYSTEMS
WIRES AND CABLES

ALL ASBESTOS WIRE AND CABLE

Sizes No. 18AWG to 1,000,000 CM.—For wiring rheostats, stoves, switchboards and electrical equipment exposed to heat or fire hazard. Also for general open wiring in hot locations. 300 and 600 volt ratings. Max. operating temperatures 200°C (392°F) and 125°C (257°F) respectively.

ASBESTOS-VARNISHED CAMBRIC CABLE

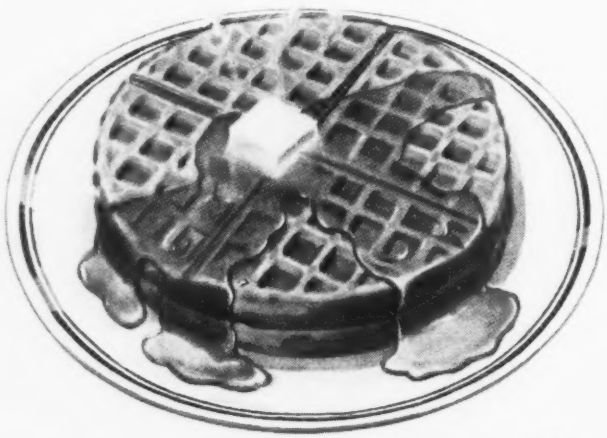
Sizes No. 18AWG to 1,000,000 CM.—For power circuits and general hot spot wiring in boiler rooms, steam tunnels, etc. 600 to 8000 volt ratings. Max. operating temperatures 110°C (230°F) and 91°C (196°F) respectively.



National Electric
PRODUCTS CORPORATION
Pittsburgh, Pa.

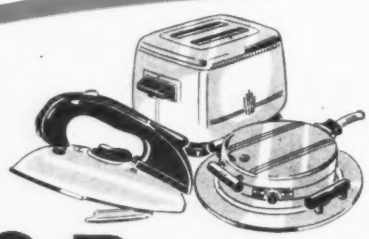
Newsworthy waffle!

Umm-m-m . . . good! Very good indeed was the first waffle to come from a Proctor waffle iron. Because Proctor had made the *first* automatic waffle iron, *first* Glow Cone signal light, *first* "OFF" switch on the waffle iron control dial. And like other Proctor appliances, that first waffle iron featured accurate thermostatic control.



But the best news is still to come!

Look for newsworthy improvements in the whole line of Proctor appliances after victory. They're on the way! Meanwhile, "back the attack" with war bonds.



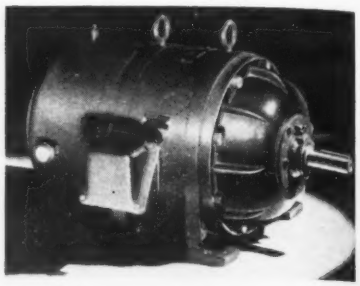
PROCTOR

NEWSMAKER IN APPLIANCE MERCHANDISING

PROCTOR ELECTRIC CO.—*DIVISION* OF PROCTOR & SCHWARTZ, INC., PHILA. 40, PA.

Explosion-Proof Motor (512)

A new class 1, group C, explosion-proof motor has been announced by General Electric Co., and is recommended by the manufacturer for use in chemical plants, hospitals and research laboratories where ethyl-ether and similar vapors are present. This motor is available in frame sizes 204-326 and in types K (normal torque) and KG (high-starting torque) and is rated at ¼ hp.



at 600 r.p.m. to 20 hp. at 3,600 r.p.m., 110, 208, 220/440, 550 volts, 60, 50, 25 cycles. According to the manufacturer, the construction is essentially the same as the class 1, group D motors, but a special flamepath is used at the shaft openings to cool the flame of internal explosions. Thermostats operate in conjunction with a magnetic controller to disconnect the motor at a predetermined temperature, but do not supplant regular overload relays.

Bushing (513)

O.Z. Electrical Mfg. Co. has a new Type SBT insulated bushing for thin wall conduit. It is made in six sizes to accommodate conduit from ½ to 2 in. in diameter. The body is malleable iron, cadmium plated. The bushing is fastened to the conduit by means of case-hardened cup point set screws that bite into conduit to prevent loosening.

Flashlight Battery (514)

Ideal Commutator Dresser Co. has announced an improved rechargeable flashlight battery, which it claims has 40% greater discharge capacity. This battery fits any standard flashlight case, using two 1¼-in. size D dry cells; also three- and five-cell cases by means of a spacer plug.

Plastic Molding (515)

Bakelite Corp. has announced development of a new low-loss phenolic plastic molding material, which it states was designed specifically to provide stable electrical insulation values, even when used under elevated temperature and high relative humidity. The material is designated as BM-16981.

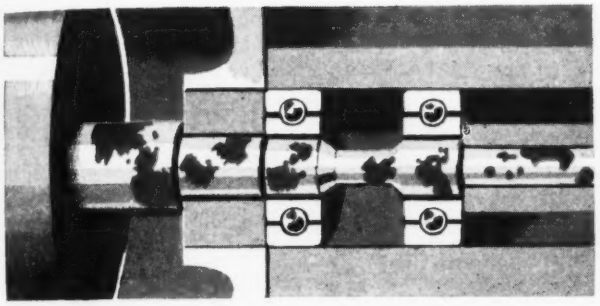
Wiring Kit (516)

An electrical repair kit for solderless wiring is being offered by Aircraft-Marine Products Inc. This kit contains tool and solderless A-MP terminals approved by Underwriters' Laboratories for stranded wire sizes 22 to 10.

Lamp Starter (517)

Burkaw Electric Co. has announced an improved fluorescent lamp starter. It is a fast action glow switch starter and features an enclosed condenser to prevent radio interference.

PREVENT RUINOUS RUST INSIDE MOTORS

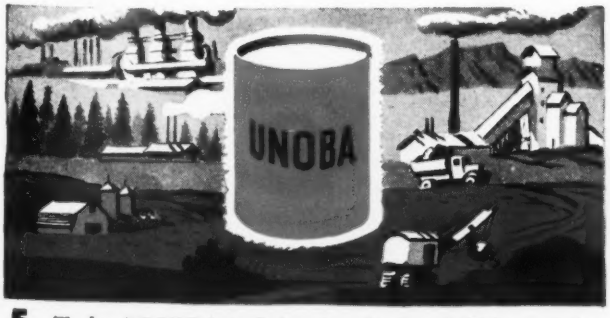


1. Electric motors get hot in service and cool off when idle. This change in temperature often causes moisture from the air to condense *inside* the motor housings with the result that the bearings rust. This soon leads to costly repairs and loss of service.

2. UNOBA, the sensational new barium-base grease exclusively developed by Union Oil Company, offers positive protection against internal rust, for it won't wash off—neither running water nor live steam will displace it.

3. Because of its exceptional properties and the care used in its manufacture, UNOBA is an *all-purpose* grease and fills the multitude of needs which previously required several different types, grades and brands.

4. You can be sure that your electric motors will get positive rust protection when lubricated with UNOBA. And, since UNOBA is an *all-purpose* grease, you can use it generally wherever grease is required.



5. Today UNOBA is doing hundreds of different jobs in all kinds of industry. It is lubricating and protecting not only the motors in mines, lumber mills, steel foundries, packing plants and construction jobs but the other machinery bearings as well.

Phone your local Union Oil representative for a supply of UNOBA today. Or write Union Oil Company, 617 W. 7th St., Los Angeles 14, Calif.

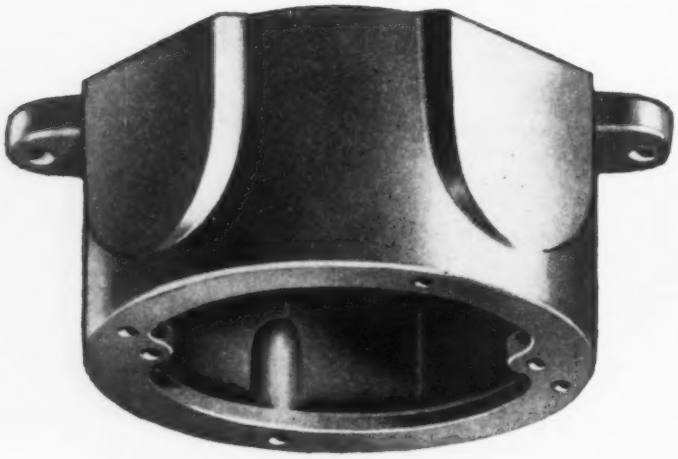
UNOBA

UNION 76

Another **UNION OIL** *Success-Tested Product*

Type GRF—the adaptable CONDULET

(CONDULETS are made only by CROUSE-HINDS)



Type GRF Condulet for Surface Mounting. With Mounting Feet.

Type GRF Condulet for Flush Mounting. With Slotted Holes for Nailing to Concrete Forms.

Adaptable — many uses. Takes blank or hub covers; terminal blocks; many Condulet accessories; standard 4" outlet box covers and wiring devices. Can be used as a

- Junction Condulet
- Plug receptacle Condulet
- Lighting fixture Condulet
- Fixture hanger Condulet

Convertible. At any time after installation Type GRF Condulets can be quickly converted to other uses, as all attachments are interchangeable.

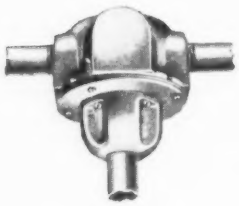
Cast Feraloy Strong and durable. Wide gasket surface for tight and weatherproof assemblies.

Bosses for drilling and tapping on sides and back. Will be furnished blank or factory tapped with tapered threads in any arrangement for ½, ¾, or 1-inch conduit.

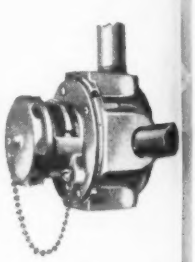
2 Styles. For flush or surface mounting.

3 Depths. 1½, 2¼, or 3 inches inside.

Listed in Condulet Catalog No. 2500, Section 15, Page 31.

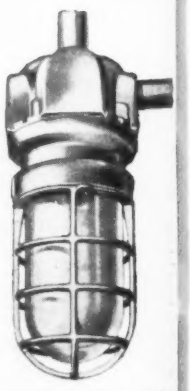


Flexible Cushion Fixture Hanger



Plug Receptacle

A Nationwide Distribution Through Electrical Wholesalers



Ceiling Type Vaportight Lighting Fixture

CROUSE-HINDS COMPANY

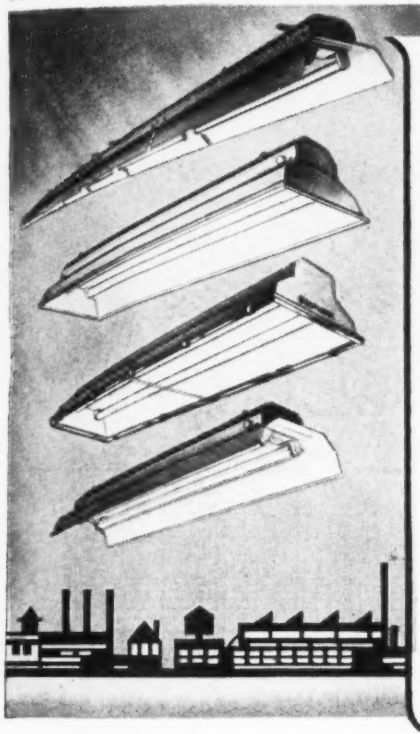
SYRACUSE 1, N. Y., U.S.A.

Offices: Birmingham Boston Chicago Cincinnati Cleveland Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee Minneapolis New York Philadelphia Pittsburgh San Francisco Seattle, St. Louis Washington. *Resident Product Engineers:* Albany Atlanta Charlotte New Orleans

CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

How "RIGHT" Lighting Helps CONSERVE MANPOWER



In these 3 Ways...

"RIGHT" LIGHTING as provided by properly applied Benjamin Lighting Equipment is helping Industry to meet today's pressing manpower problems...

1. **Protects plant personnel against accidents.**
2. **Conserves energy and reduces fatigue.**
3. **Helps older employees to "Stay-on-the-Job"**

PROMOTES SAFETY! "Right" Lighting is helping in the solution of the aggravated Safety problem. It is providing enough light to enable the individual to see *hazards easier and more quickly.*° It takes time to see*. The more light, the less time needed to see and act; the fewer accidents!°* "Right" Lighting makes *seeing easier and less tiring.*

To secure such lighting requires attention to many details such as the elimination of unshielded or improperly shielded light sources, proper painting of walls, ceilings, machines and working surfaces, and provisions for uniform distribution of the light over the work areas.

COMBATS FATIGUE. Not only is fatigue the cause of accidents, but also, an important factor in rate and quality of production, absenteeism, health and morale. "Right" Lighting helps solve the fatigue problem by reducing the drain on the worker's reserve energy. For seeing requires energy!* The better the lighting, the less the drain!*

KEEPS OLDER MEN ON JOB! "Right" Lighting benefits the older employee and those with deficient vision of all ages even more than those with normal vision. More light helps compensate for visual deficiencies and the loss of visual acuity due to age. Given this additional light, the manpower represented by this large group can be efficiently utilized for war production.°

Write for Free Booklet entitled "Productive Lighting" containing much valuable information on how Benjamin Lighting Equipment enables you to obtain "Right" Lighting for your plant.

BENJAMIN ELECTRIC MFG. CO. Dept. J Des Plaines, Illinois

°from booklet "Plant Efficiency" published by War Production Board
**from I.E.S. report "Value of Good Lighting in War Production"*

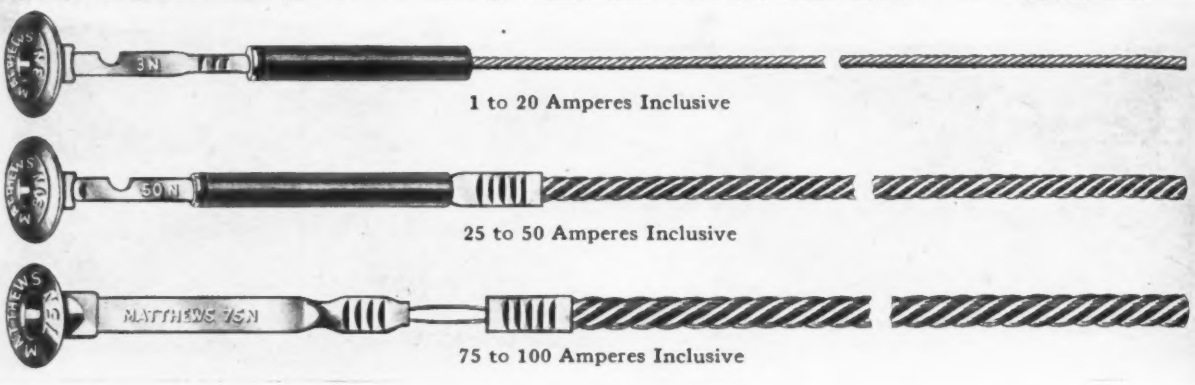
BENJAMIN — Your Warranty of Uniform Quality

BENJAMIN TRADE MARK *Lighting Equipment*

Distributed Exclusively Through Electrical Wholesalers

814

STRONGER AND MORE ACCURATE
MATTHEWS FUSE LINKS
SERIES 100-H AND 50-H UNIVERSAL.
FOR ALL PRIMARY CUTOUTS



1 to 20 Amperes Inclusive

25 to 50 Amperes Inclusive

75 to 100 Amperes Inclusive

125—150—175 and 200 AMPERE FUSE LINKS ARE ALSO AVAILABLE

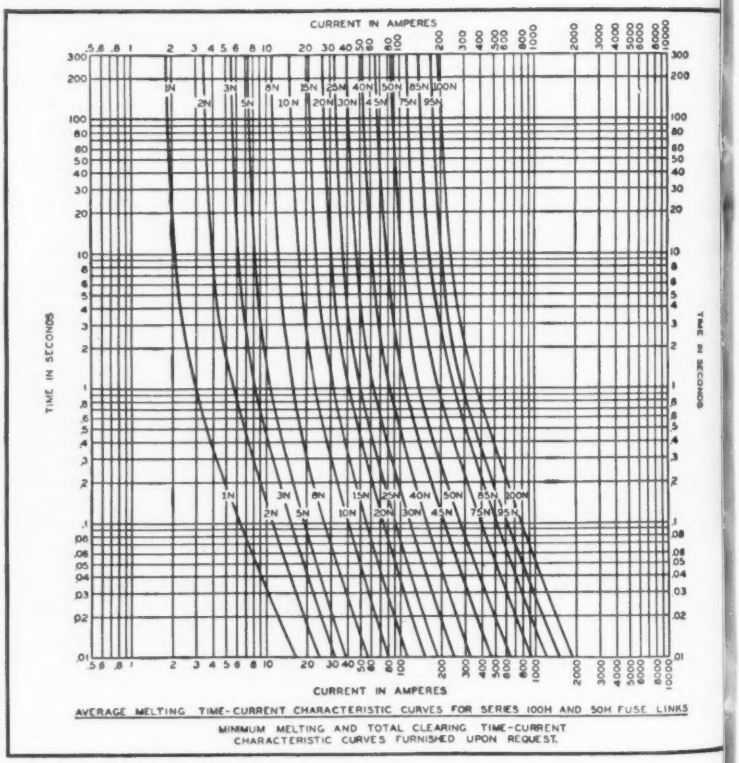
Series 100-H and 50-H Universal Matthews Fuse Links are designed to comply with NEMA Standards—Publication 38-53.

Mechanical crimping (rather than soldering of parts) insures greater accuracy, uniformity and strength.

The fuse links from ½ to 20 amperes inclusive, are equipped with stainless steel compression springs to assist in the separation of the fusible element. Springs are not necessary on the fuse links above 20 amperes because of the greater expulsion action.

All fusible elements are protected by horn fibre tubes. The Series 50-H Fuse Links are equipped with ½ inch diameter cupped fuse heads, while the Series 100-H up to 50 amperes inclusive, have in addition, ¾ inch diameter removable cupped washers. On the sizes above 50 amperes, ¾ inch diameter cupped fuse heads are furnished. Flexible copper cable is lead coated for greater resistance to corrosion.

They are packed in individual paper tubes, 25 to a telescoping container.



AVERAGE MELTING TIME-CURRENT CHARACTERISTIC CURVES FOR SERIES 100H AND 50H FUSE LINKS

MINIMUM MELTING AND TOTAL CLEARING TIME-CURRENT CHARACTERISTIC CURVES FURNISHED UPON REQUEST.

Full Scale Time Current sheets will be furnished on request

All Matthews Fuse Links comply with NEMA's "N" Standards, and conform to WPB Limitation Order L-154, Schedule 4.

Write for Bulletin 533 for Complete Information.

W. N. MATTHEWS CORPORATION

SAINT LOUIS, U. S. A.

ENGINEERS and MANUFACTURERS SINCE 1899

INTERSECTIONS

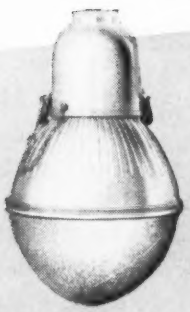
RETAIL-BUSINESS DISTRICTS

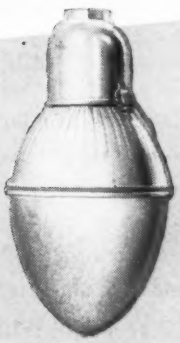
MAIN ARTERIES

RESIDENTIAL STREETS

For ALL parts of town... yet ALL of one family

NOVALUX FORM 79 LUMINAIRES





(Above) FORM 79-R Narrow, asymmetrical distribution. Especially adaptable to main arteries and highways

(LEFT) FORM 79-VR Narrow-band (180 deg) distribution—best for residential streets.

(Above) FORM 79-S Non-directional, shaded distribution for intersections and open areas

(Above) FORM 79-D Wide, asymmetrical distribution for unusually wide streets and parkways

These luminaires give you the benefits of standardization, including reduced installation and maintenance costs, without sacrificing "tailored-to-measure" lighting results.

Form 79 luminaires are basically alike, even though each type is designed to do a particular job. All have the same maintenance-saving features. They "go up" the same way. They are serviced the same way. Most replacement parts are identical. They have in common many worth while features that help keep maintenance costs low.

This standardization doesn't limit your opportunity to fit street lighting to your local situation, because the Form 79 optical system is so highly adaptable. Form 79 VR, for example, makes possible new standards of illumination from *widely spaced* units. And it offers great advantages on residential streets, keeping the light on the street, not on the houses.

G-E specialists in street lighting are at your service if you need help in planning a comprehensive modernization program. *General Electric Company, Schenectady 5, New York.*

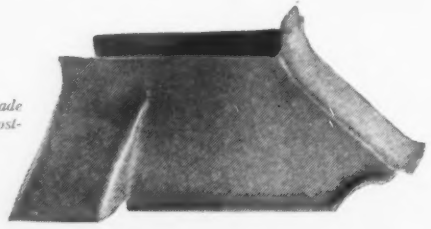
Are you tieing-in with the NEMA plan to give America better street lighting?

GOOD STREET LIGHTING BUILDS GOOD WILL

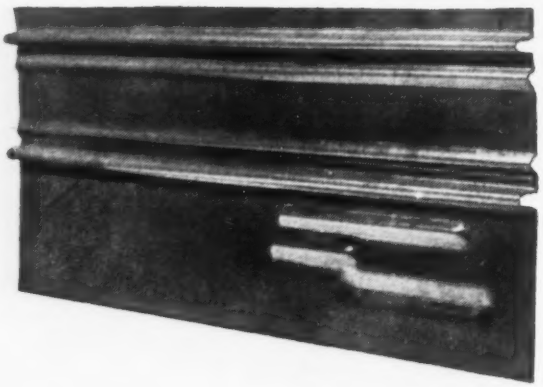
Buy all the BONDS you can—*and keep all you buy*

GENERAL ELECTRIC

452-31-3010



Typical shapes made from Lamicoid Post-Forming Stock.



LAMICOID POST-FORMING STOCK

Works Easily for Deep Drawing and Forming of Intricate Parts

Lamicoid, the laminated plastic which has long been used for many electrical and mechanical applications, is also available in sheet form for post-forming.

Sheets, 36″x42″ and in thicknesses of 1/32″ and over, are of two types: E-527, for deep drawing and forming of intricate parts; E-528, for ordinary forming and shallow drawing.

Because of the special materials used in the manufacture of this stock, it can be formed or drawn without breaking down the fabric or weakening the drawn parts.

Lamicoid Post-Forming Stock has been used extensively in the aviation industry and has many applications where good electrical properties, strength and light weight are desired.

Lamicoid Post-Forming Stock is available from any of the offices or distributors listed below.

MICA INSULATOR COMPANY

200 VARICK STREET, NEW YORK 14, N. Y.

Chicago: 600 West Van Buren Street • Cleveland: 1276 West 3rd Street Detroit: Book Building • Cincinnati: 3403 Hazelwood Avenue • Boston: 285 Columbus Avenue • Lamicoid Fabricators, Inc., 3600 Potomac Avenue, Chicago, Ill. • Insulating Fabricators, Inc., 69 Grove Street, Watertown, Mass. • Insulating Fabricators, Inc., 12 East 12th Street, New York City • The Kirby Co., 13000 Athens Avenue, Cleveland, Ohio

Electric Irons (518)

Proctor Electric Co. has announced that it is shipping the first of its allotment of electric flatirons. The model in production is a 1,000-watt, a-c iron with bakelite handle, permanently attached cord, speed selector and a dial of fabrics.

F Unit (519)

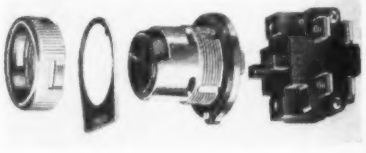
Edwin F. Guth Co. has announced that its Quick-Liter unit is available now as a heavy-weight model. This model features a lateral-ribbed reflector, which is said to act as corrugations in a metal barrel to minimize dents due to accidental blows. It is a combination hot and cold cathode fixture and, according to the announcement, operates at low and irregular voltages and under extreme temperature conditions. Available in two and four 40-watt fluorescent lamp sizes for 115- or 230-volt, 60-cycle, a-c operation.

Alloy for Connectors (520)

Burndy Engineering Co. has announced that it is using a new high-strength alloy for all cast, current-carrying parts of electrical connectors. This alloy is said to be the same as Burndy's high copper alloy 113 but to have the addition of Lithium, which adds almost 20% to tensile strength. Elongation is increased 20% and the coefficient of friction is reduced, it is stated.

Push Buttons (521)

Designed primarily for group mounting on machinery or control enclosures, a new line of oil-tight push buttons has been introduced by Square D Co. Other features claimed for the new line are compactness without sacrifice of accessibility; quick, easy installation; flexibility.



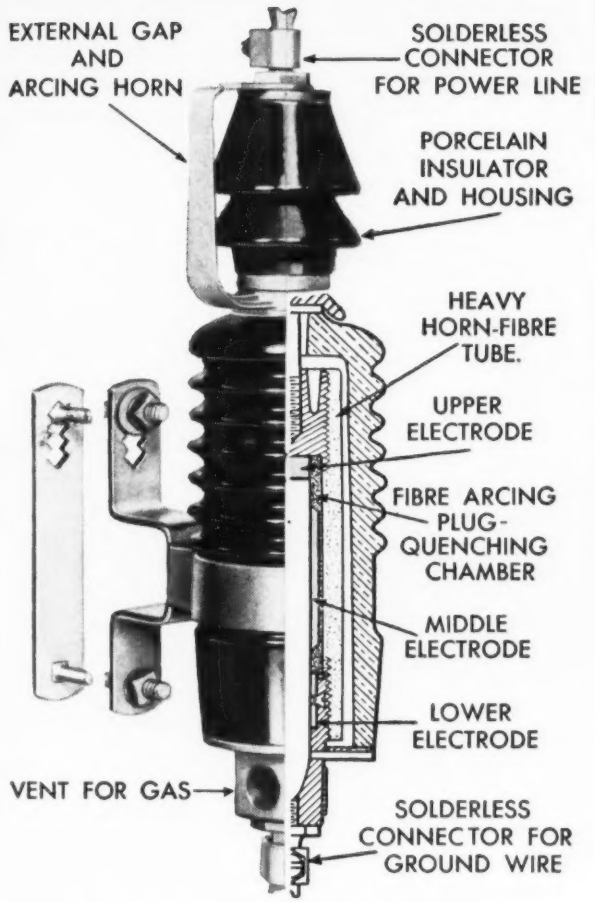
Transmitter (522)

Bendix Radio division of Bendix Aviation Corp. has developed a single-crystal mobile transmitter which can be set for any frequency in the 100-156 megacycle band.

Welding Positioner (523)

Standard Machinery Co. has introduced a multi-purpose welding positioner for rotating work up to 700 lb. at speeds from 0 to 2.4 r.p.m. in either direction by hand wheel control.

HOW TO GET safe LIGHTNING PROTECTION



SIZES: Type PF Expulsion Arresters are made in three sizes, rated at 3, 6, and 9 kv.; cross arm or flat mounting hangers.

Ask the L-M Field Engineer—Discuss your requirements freely with the L-M Field Engineer. L-M makes many types of lightning protective devices; he can give you an unbiased recommendation based on his own knowledge and the company's wide research and field experience. Call or write the nearest L-M branch office or Line Material Co., Milwaukee 1, Wis.

L-M Heavy Duty Expulsion Type Lightning Arrester

L-M Heavy Duty Expulsion Type Lightning Arresters give a high degree of protection. Superior design assures low sparkover, low IR drop, and discharge capacity adequate to handle severe surges with ample margin of safety. L-M wedge-shaped arcing chamber is designed to keep fibre erosion at a minimum, thus assuring long, trouble-free life. Get details from the L-M Field Engineer, nearest L-M branch office, or Line Material Co., Milwaukee 1, Wis.

FEATURES OF L-M TYPE PF EXPULSION ARRESTERS

Discharge capacity ample; passes 65,000-ampere surge test.

Sparkover sufficiently low for ample protection to transformer with a large safety factor.

IR Drop extremely low. To take full advantage, all leads should be as short as possible.

No Radio Interference

Follow current interrupted at end of first half-cycle.

Long Service Life: wedge-shaped design keeps erosion of fibre at a minimum, assuring long, trouble-free service.

External gap insulates fibre parts from line voltage except during surge conditions.

Moisture Seal not needed.

FIBRE GAP DESIGN SHOWS L-M SUPERIORITY

LEFT: Inside of fibre arcing chamber: the three electrodes form two internal gaps, and provide excellent sparkover characteristics.

Cross section of chamber. Wedge presses arc into thin sheet, so that even small follow currents are promptly extinguished. Wide part is ample space for venting the gases.

As a surge reaches arrester, it sparks over external gap at top, jumps the two internal gaps, then flows to the ground, thus protecting transformer from damage.

The 60-cycle current tends to follow the surge and maintain the arc. To interrupt this follow-current is the function of the fibre arc-extinguishing chamber.

The arc produces gas from the fibre in the wedge-shaped passage. This gas quenches the arc by expulsion action at the end of the first half cycle, the instant the current passes through zero.

Long intermediate electrode exposes a large area of fibre to the arc, combining large expulsion action with short sparkover distance for the surge.

LM

LINE MATERIAL
LIGHTNING ARRESTERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters
Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

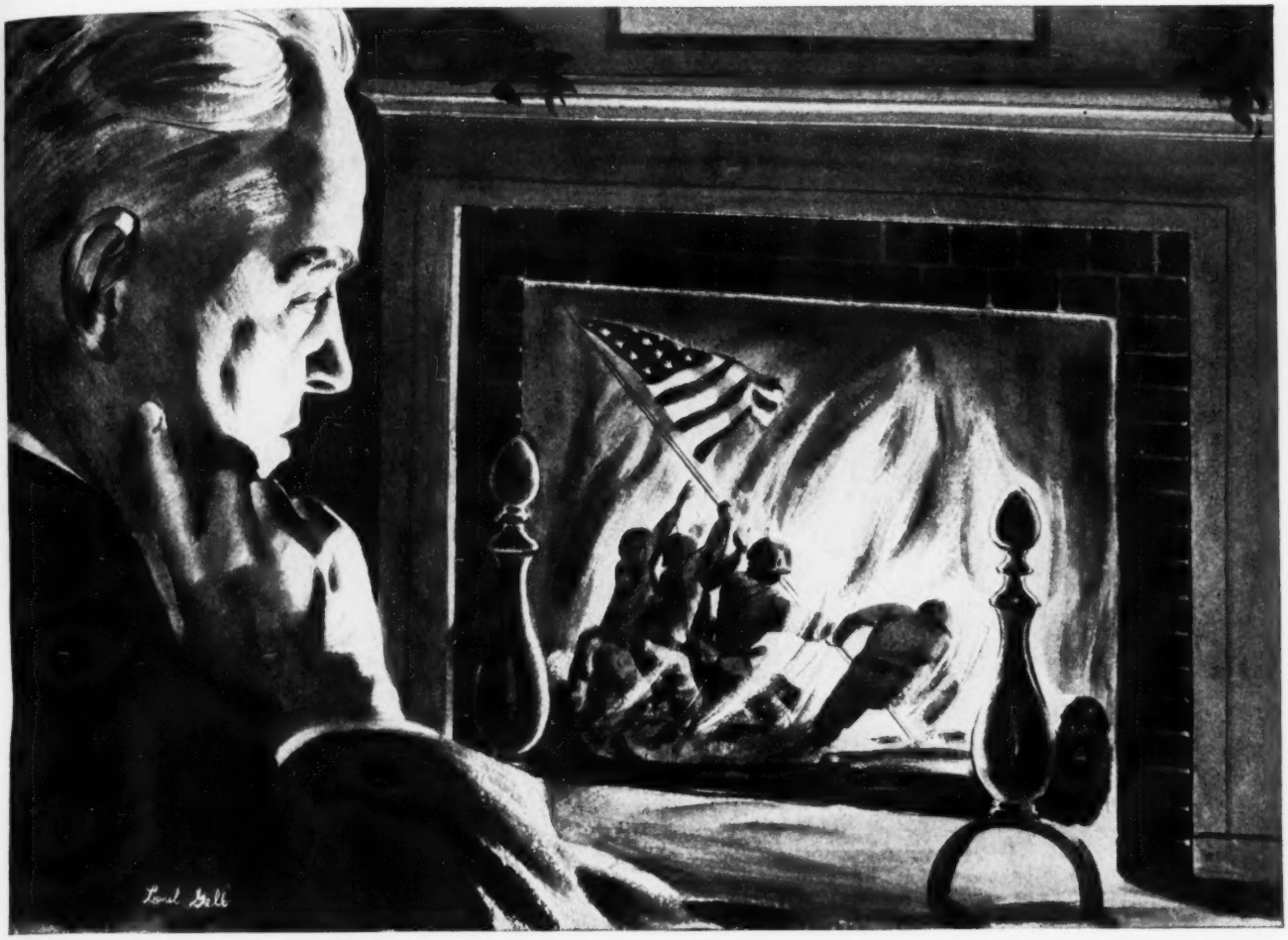
IN FIFTEEN short years Essex *Extra-Test* Magnet Wire has reached an enviable "first-choice" position in the field.

A natural advancement—for it has always been a rigid Essex policy never to be content with just good wire. Every spool that leaves the plant must carry *extra-good* wire—the best that can be made—whether it is size 50 or 0; round, square or rectangular; bare, covered or enameled.

Such superiority is the direct result of extensive development work and severe laboratory tests. Made from commercially pure electrolytic copper, Essex Magnet Wire is drawn to size under most careful supervision, and subjected to continuous physical and electrical tests for purity, temper, elongation, conductivity, and gauge. Insulation tests are equally frequent and severe. And in every case, *results must exceed standard requirements.* Many are far in excess of most rigid specifications.

That's why Essex Magnet Wire has been so literally labeled, *"Extra-Test".*

ESSEX WIRE CORPORATION
FORT WAYNE 6, INDIANA



. . . who in hell am I?

You soldier—you sailor—you coastguard—you marine—
It's difficult to put across exactly what I mean;
I won't get sentimental (though I feel it deep inside)
I don't want to embarrass you nor shame your decent pride;
You struck no blow for me—you didn't even know my name,
And if you had, why who in hell was I? But just the same
I owe you something, and I've got to get it off my chest;
Because you shoot, I get to eat; because you march, I rest.
Because you're over there, I've got a home, a vote, a job—
Because you are a leatherneck, a devil dog, a gob,
I am a man who's never seen death raining from the skies,
Or cold and famine killing folk before my very eyes.
I am ashamed to owe so much, to get such treasure free,
To have such blood and labor lavished on a guy like me—
Me, and a hundred million more, who cannot work and sweat
Quite long enough, quite hard enough, ever to pay the debt.
We breathe the air of freedom, and we tread our native ground
And nobody is jailing us or pushing us around,
No foulness wrecks our heritage, no tyranny is blighting
The bounty of our motherland—because you're in there fighting!

—Ted Robinson in the Cleveland Plain Dealer

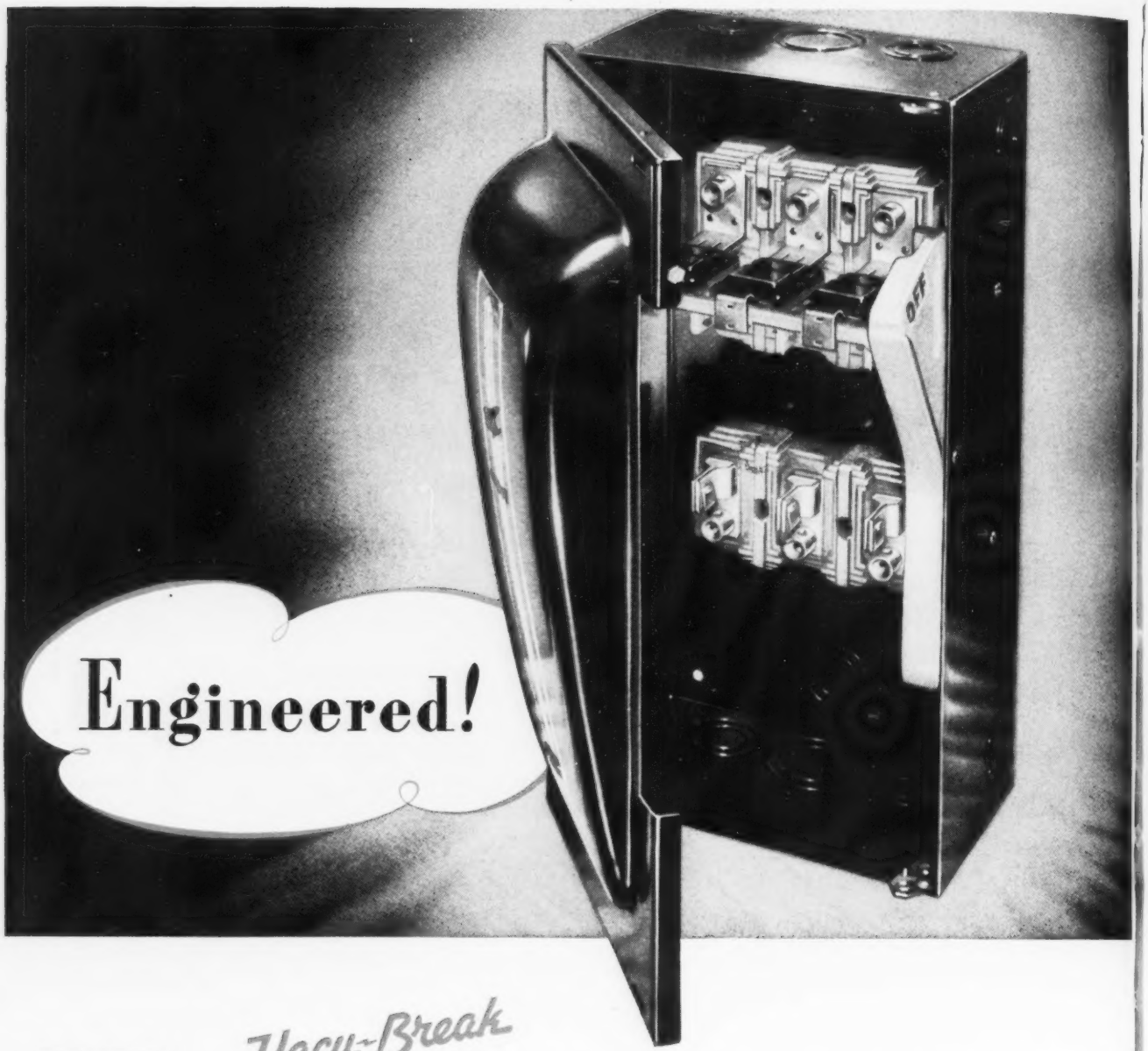
★

As with our entire production facilities—now with our advertising—Railley's energies are single-mindedly devoted to America's war effort.

DIG DEEP! 7th WAR LOAN

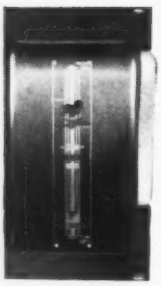
Now Making for Victory: X-RAY PARTS • GAS PROOF COVERS
ROCKET PROPULSION UNITS • DUMMY FUZES • PRACTICE CARTRIDGES

Railley
CORPORATION · CLEVELAND, OHIO
ORIGINATORS OF THE PIN-IT-UP LAMP



Engineered!

Vacu-Break



SAFETY SWITCH WITH "CLAMPMATIC" CONTACTS

BullDog technicians put in years of laboratory research to develop these advanced principles in safety switch design — more years of experimental engineering to *prove* them. Result: The BullDog Vacu-Break Safety Switch — far ahead of the field!

No other safety switch has the Vacu-Break principle of arc suffocation—Clampmatic contacts tight as a bolted connection in the *ON* position, thus reducing heating — simplified mechanism for positive operation — modern streamlined cabinet — ample interior wiring space without sacrificing over-all compactness. Capacities from 30 Amp. to 1200 Amp.

Take the word of top-flight engineers in leading plants of the nation. Or investigate for yourself. Write for illustrated folders.

BUY WAR BONDS

BULLDOG

ELECTRIC PRODUCTS COMPANY

SALVAGE PAPER

BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN. In Canada: BullDog Electric Products, Ltd., Toronto. Field Engineering Offices in All Principal Cities.

Also Manufacturers of

SafToFuse Panelboards—Switchboards—Circuit Master Breakers — BUStribution DUCT, for "plug-in" power — Universal Trol-E-Duct, for flexible lighting—Industrial Trol-E-Duct, for moving "loads."

BULLDOG PRODUCTS ARE SOLD AND DISTRIBUTED BY THE FOLLOWING PACIFIC COAST REPRESENTATIVES:

Coast Electric & Manufacturing Co.
1720 N.E. Sixth Avenue
Portland, Oregon, Tel. Garfield 2844

Safety Switchboard & Manufacturing Co.
1445 Stevenson St.
San Francisco, Calif., Tel. Hemlock 2470

Mullenbach Electrical Manufacturing Co.
2300 East 27th Street
Los Angeles, Calif., Tel. Jefferson 2224

BENEFIT BY Okonite EXPERIENCE

in design • manufacture installation of SUBMARINE CABLE

To handle this 11,999-foot length of Okonite Submarine cable shipped recently to a naval base, a specially-designed, electrically-driven reel was used.

The 23,000 volt cable with 1/0 conductors was 3.5 inches in diameter and weighed 15½ lbs. to the foot. Weight of the cable alone was 93 tons, and the cable, reel and accessories (including A-frames, bearings and lifting beam for handling) had a total weight of 105 tons. The reel was 9.2 feet high and 17 feet wide. Four such shipments were involved.

For helpful information regarding insulated wires and cables for every electrical purpose, get in touch with Okonite engineers.

The Okonite Company, Passaic, New Jersey.

ARMY E NAVY

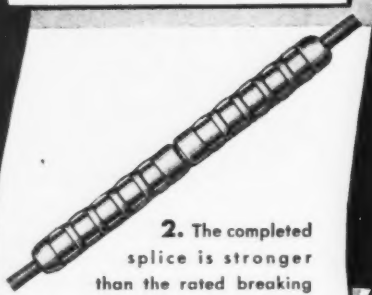
OKONITE OKONITE SINCE 1878

insulated wires and cables

4078

YES! THERE'S A SPECIAL
Nicopress
SPLICING SLEEVE
★
for "80" and "130" High Tensile Steel Power Conductors

1. Whether the joint is to be made in the air or on the ground, the job can be done faster and easier with Nicopress galvanized steel splicing sleeves.



2. The completed splice is stronger than the rated breaking strength of the wire itself.

The National Telephone Supply Company
5100 SUPERIOR AVENUE
CLEVELAND 3, OHIO
Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA
Export Distributor
INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

BULLETINS

data books, etc.

Insulating Varnishes (524)

Properties of Dow Corning silicone insulating varnishes are given in a new bulletin on the company's DC 993 varnish. Advantages, application and specifications are listed in the eight-page release, which also includes samples of heat resistant insulations made with DC 993, a varnished glass cloth and a bonded mica glass cloth.

Lighting Design (525)

General Electric Co. has released another in its series on postwar lighting. A 12-page booklet, the new presentation contains a home lighting plan designed by Theodore Criley, Jr., director of Southern California Chapter, AIA, and architect-engineer for housing projects in California, Nevada and Arizona.

Insulation (526)

Continental Diamond Fibre Co. has issued a new bulletin on electrical insulating materials. This 28-page illustrated bulletin includes data on standard NEMA grades of phenolic laminates, information on tests and complete data on several types of electrical insulating materials.

Terminal Blocks (527)

Burke Electric Co. Controlead terminal blocks are described in a six-page bulletin released recently. Included are cross section views, dimensions and prices of the ten types of terminal blocks manufactured by the company.

Rubber Adhesives (528)

B.F. Goodrich Co. gives information on its natural and synthetic rubber adhesives in a 12-page bulletin recently issued. Directions for application of rubber cements are included and synthetic rubber cements for synthetic rubber products are described. How to choose the right kind of cement for various applications is discussed and differences between vulcanizing and non-vulcanizing types of rubber cement are outlined. A table gives data on cement weights, colors and base materials used.

Electric Timers (529)

C. H. Stoelting Co. has a bulletin describing its electric timers, including table and wall model stop clocks, precision chronoscopes, combination timers and impulse counters, stop watch controllers and spring wound X-ray timers.

Motor Selection (530)

"Fractional Horsepower Motor Selector" is the title of a booklet available from the Dumore Co. This data book tells in outline form how to select types and sizes of fractional horsepower motors for various applications.

Distribution Plans (531)

A booklet giving a brief history of the company and its policies and organization, with proposed postwar distribution, has been prepared by Graybar for management, production and purchasing executives.

Flow Meters (532)

Selection data for its line of flow measuring instruments is given in a 16-page publication offered by the Cochrane Corp. Specific gravities of gases and of various metals used in floats are given, as are formulae for converting water and air capacities to terms of other liquids and gases. Pressure drop, length of scale and float material are included.

Fluorescent Fixtures (533)

Sylvania Electric Products has a new booklet containing information on industrial, commercial, portable and inspection type fluorescent fixtures; F lamps, starters and lamp holders.

Capacitors (534)

Sprague Electric Co. has prepared a 56-page catalogue on its paper dielectric capacitors. Notes on capacitor selection and use are included.

ELECTRICAL WEST, 68 Post St., San Francisco, 4, California
Please send me information about following CIRCLED items:

500	501	502	503	504	505	506	507	508	509	510
511	512	513	514	515	516	517	518	519	520	521
522	523	524	525	526	527	528	529	530	531	532
533	534									

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* Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.

Of course the Sheik is confused by Laytex-insulated wire. He's one of the countless number of men now seeing wire for the first time. In hot deserts and tropical jungles, in distant islands and freezing arctic lands—places where electricity has never before been harnessed, Laytex is demonstrating its marvelous properties as a wire. To many of the people in these lands, wire henceforth means Laytex.

But to us here at home, Laytex is *more* than the average wire. Under the strain of world-wide war, Laytex gives better performance than was ever expected of any wire under such gruelling conditions.

Military needs now take the entire output of Laytex Wires and Cables. But we hope the day is not far off when manufacture will be resumed for Residential and Commercial Building, Police and Fire Alarm Systems, Communications, Signalling, Power Control and other exacting services.

Rubber Insulation at Its Best

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ELECTRICAL WIRES AND CABLES

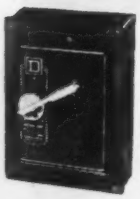
Serving Through Science

UNITED STATES RUBBER COMPANY

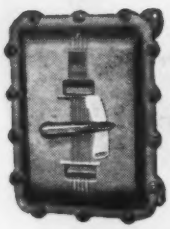
1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y. • *In Canada:* DOMINION RUBBER CO., LTD.

THERE IS A SQUARE D *Circuit Breaker* FOR EVERY TYPE OF INDUSTRIAL APPLICATION

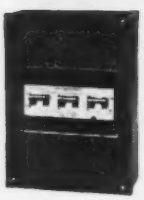
Rain-tight Multi-breakers with a variety of circuit arrangements for such outdoor applications as lights, signs, etc. Also Multi-breakers and circuit breakers in weather and dust-tight and explosion-resisting enclosures.



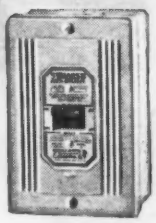
Industrial Multi-breakers are available in capacities from 15 to 100 amperes, with 2 or 3 poles. Quick make, quick break with dust-resisting sheet steel enclosures; also, explosion-resisting types. Front operated with trip indication.



Weatherproof, Dust-tight and Explosion-Resisting Circuit Breakers are furnished in cast iron enclosures with gray enamel finish. Standard conduit openings in the ends. Capacities—15 to 600 amperes up to 575 Volts.



Multi-breaker Type M Load Centers with 50 ampere frame breakers for applications involving 120-240 volt AC circuits. Available with varied number of single and double pole breakers of 15-20-25-35 and 50 ampere ratings. 100 ampere bussed mains available if required. Choice of surface or flush mounting devices for indoor installations and raintight boxes for outdoor applications.



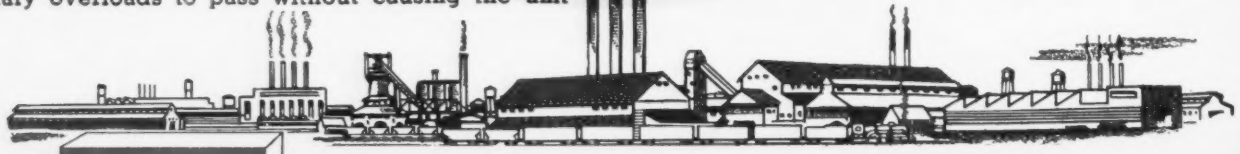
MO Multi-breaker for use on small machines such as drill presses, grinders, riveters, staplers, saws, beaters, etc. Available in single and double pole or for 2 and 3-wire systems. 15, 20 and 25 amperes. Price is comparable to Type D switches.

Industrial Circuit Breakers in standard sheet steel enclosures are available in capacities from 15 amperes to 600 amperes, up to 575 Volts. Made in 2 and 3 poles and for 3 and 4-wire systems. These devices are quick make and quick break with trip indication.

Multi-breaker Load Centers for controlling and protecting lighting and small power circuits. Made in a variety of circuit arrangements with capacities of 15, 20, 25, 35 and 50 amperes, for either 2 or 3-wire service, with individual trip.

Multi-breaker Load Centers in Cast Iron Enclosures for Class I, Group D and lower applications. Can be furnished for 2 and 3 wire solid neutral systems—up to 8 single pole circuits or combination of single and double pole. These cast enclosed Multi-breakers enjoy a wide variety of applications wherever explosive atmospheres exist.

• **Square D Circuit Breakers** provide quick restoration of service after short circuit or overloads. They eliminate fuses and reduce maintenance cost since no replacement of parts is necessary. • Built into every Square D circuit breaker is a time-lag feature which permits harmless momentary overloads to pass without causing the unit to disconnect the circuit. • Square D's line of circuit breakers is unusually complete, assuring the right unit for any given installation. • See our catalog in Sweet's or write for Industrial Circuit Breaker Bulletin. *Address Square D Company, 1318 East 16th Street, Los Angeles 21, California.*



SQUARE D COMPANY

LOS ANGELES 21 • SAN FRANCISCO 3 • SEATTLE 1 • DENVER 4 • DETROIT 11 • MILWAUKEE 2

A Glimpse of things to come...

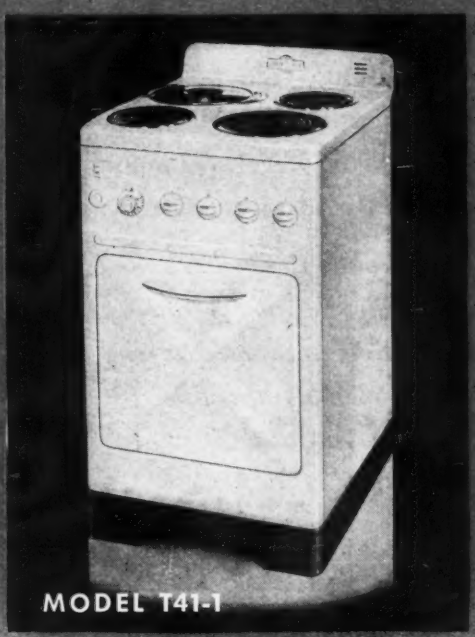
This "electric range for tomorrow" is one of several sketched for Electromaster by George W. Walker, noted industrial designer.

CLEAN, streamlined houses, radios, factories, and cars are in store for tomorrow's world, complete in every detail—on the drafting boards of America's industrial designers. So, too, Electromaster is busy designing the electric range that will exactly suit the taste, convenience and pocketbook of Mr. and Mrs. Homemaker.

We aren't yet ready to divulge what this range of the future will be, but this we do know. It will combine sound engineering with attractive appearance to offer maximum ease and economy of cooking operations.

For example, Electromaster Model T41-1 features thick spun glass oven insulation, large twin unit oven, removable crumb tray, and convenience outlet. A compact, attractive range offering full cooking capacity in minimum floor space.

Look to Electromaster for maximum safety, efficiency, and convenience. A few territories are still open to dealers.



ARMY E NAVY

Electromaster

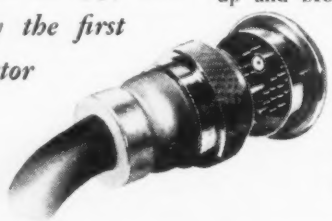
1807 EAST ATWATER STREET DETROIT 31, MICHIGAN

TELEVISION, SINCE PIONEER DAYS, HAS DEPENDED UPON CANNON PLUGS

Because Cannon Plugs and Receptacles were designed especially for use in critical circuits, they were incorporated into the first television hook-ups. Says Harry R. Lubcke, Director of Television for the Don Lee Broadcasting System:

"We find Cannon Connectors indispensable in our television operations. We called on Cannon in 1937 and what was probably the first all-television connector was fabricated."

All the circuits of a modern television camera pass through this single master Cannon Connector mounted on the side of the instrument. Equipment for the control of focusing, power and intensity of image is connected to power sources and to pick-up and broadcasting equipment through Cannon Plugs.



If you are interested in equipment of this kind, write for Cannon Condensed Catalog. Address Dept. A-207, Cannon Electric Development Company, 3209 Humboldt Street, Los Angeles 31, Calif.

CANNON ELECTRIC

Cannon Electric Development Co., Los Angeles 31, Calif.

Canadian Factory and Engineering Office: Cannon Electric Company, Ltd., Toronto, Canada

REPRESENTATIVES IN PRINCIPAL CITIES—CONSULT YOUR LOCAL TELEPHONE BOOK

BOOKS

you may want

ELECTRICAL DRAFTING, by D. Walter Van Gieson, 140 pages, 8½ x 5½, McGraw-Hill Book Co., $1.50.

In this new book, the author points out that textbooks covering mechanical drawing have treated working drawings of electrical machines but that drafting technique, as applied to electric circuit diagrams and wiring plans, has been given little consideration. In this little book, he seeks recognition of this special kind of drawing and offers practical guidance to the potential electrical draftsman who has an elementary knowledge of the electric circuit.

Twenty-five short chapters, together with an appendix of tables and abbreviations, present simple and typical wiring plans of various applications ranging from lighting and power to radio, television, and aircraft. In addition, short chapters on subjects such as office practice, notes and specifications, and drafting kinks are included.

As a text book for trade schools or for self instruction, this book should prove quite useful in introducing the student to the specialized field of electrical drafting. The problems and test questions given at the end of each chapter should be particularly valuable to the earnest student.

In later editions of the book, certain changes might be made to advantage. As an example, the transformer polarity markings in one diagram indicate the old practice of additive polarity instead of the modern standard of subtractive polarity. The table of conduit and wire sizes in the appendix does not agree throughout with the National Electrical Code and the conduit sizes are based on easy pulling of wires around three bends whereas general drafting room practice usually bases such tables on easy pulling around two bends. However, on the whole, the book should be of value to beginners and as a basis for electrical drafting practice where the subject is taught.—E.R.S.

ELECTRIC POWER DISTRIBUTION FOR INDUSTRIAL PLANTS, 109 pages, 8 x 11, contents, illustrated, American Institute of Electrical Engineers, 33 West 39th St., New York, $1.00.

A useful assembly of widely diversified information on design of electrical power distribution systems for industrial plants. It treats of all phases of the subject from source of energy to utilization devices. It should prove valuable to industrial engineers, power company salesmen and others who may need reliable information on industrial design problems. Professional capacities of the more than forty contributing authors indicate the scope and prestige of the report. Authors have drawn from the wealth of their own experience in a manner that makes it available to all in concise form.

HIGH-FREQUENCY INDUCTION HEATING, by Frank W. Curtis, McGraw-Hill Book Co., 367 pages, illustrated, $2.75.

With present-day interest in the possible applications of high-frequency to heat treating and other industrial uses, this book brings the first practical and authoritative compilation of this new technique to the man seeking the facts and data from which to apply the method to his own processes.

(Continued on Page 52)

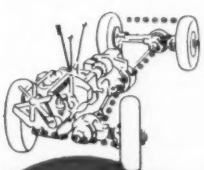
Preferred for line construction and maintenance trucks, the FWD Model HST embodies the accumulated experience of 35 years of FWD leadership in four-wheel-drive trucks.

HOW FWDs ARE Easing the Manpower Shortage FOR UTILITIES

Despite wartime handicaps . . manpower shortages, over-worked equipment and other limitations . . . utilities are meeting unprecedented emergency demands. FWD trucks are helping more than 150 utility companies maintain their traditional reputation for unfailing service

FWDs add to the work range and capacity of available crews and equipment. On or off the pavement, cross-country or on main highways, FWDs get through to location. The extra dependability — the full power and traction of four driving wheels — the rugged construction where ruggedness counts — the ability to haul longer for less in gas, oil, tires and maintenance — have won for FWDs preferred ranking as tough, unusually able line-construction and maintenance trucks.

FOR ESSENTIAL INDUSTRIES, a limited number of FWDs will be available this year. Phone, wire or write us, or see the nearest authorized FWD dealer.



THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin
Canadian Factory: KITCHENER, ONTARIO

F W D Distributors

ARIZONA—Arizona-Cedar Rapids Co., 401 N. 1st St., Phoenix, Ariz.; CALIFORNIA—Hillman-Kelley Company, 1000 Macy St., Los Angeles and FWD Pacific Co., 469 Bryant St., San Francisco 7, Calif.; COLORADO—Liberty Trucks & Parts Co., P.O. Box 1889, Denver 1, Colo.; IDAHO—Intermountain Equipment Company, Broadway at Myrtle St., Boise, Idaho; MONTANA—Steffeck Equipment Co., 11 E. Cutler St., Helena, Mont.; NEVADA—Allied Equipment Co., Reno, Nevada; NEW MEXICO—The Myers Company, Las Cruces, N.M.;

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THE ORIGINAL EXCLUSIVE BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS

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400,000 New Customers in

ONE ANSWER TO YOUR POSTWAR LOAD-BUILDING PROGRAM

In spite of wartime restrictions and shortages, 1944 showed an increase of over *400,000 domestic users* of electricity!

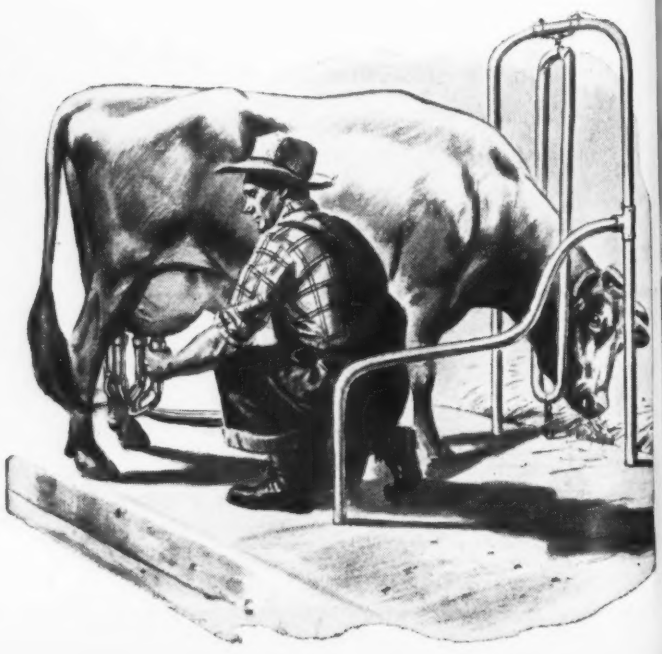
That wartime gain points straight at one big postwar market for your surplus power! . . . the *domestic market*!

And right now Utilities and Appliance Manufacturers should be working to develop an increased postwar demand.

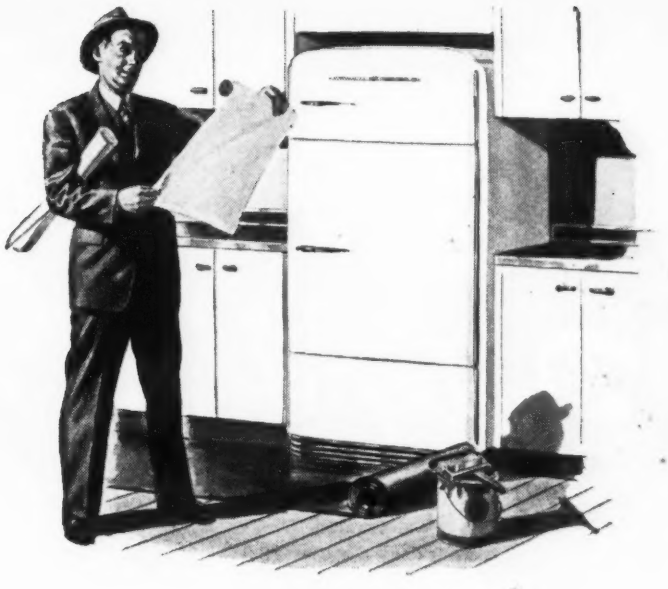
The "big three" in the domestic market will be the housewife, the builder, the farmer.

The housewife can be encouraged to use *more* appliances.

The builder can be influenced to include *complete* electrical equipment in postwar homes.



1944



The farmer can be helped to get *all* the benefits of electric living.

Let's Make The Home Of Tomorrow An All-Electric Home

General Electric is working now to convince the public that electrical living is better living!

Reaching housewives with one of the largest daytime radio shows . . . . *The G-E House Party* . . . available to a potential audience of 28,000,000 homes.

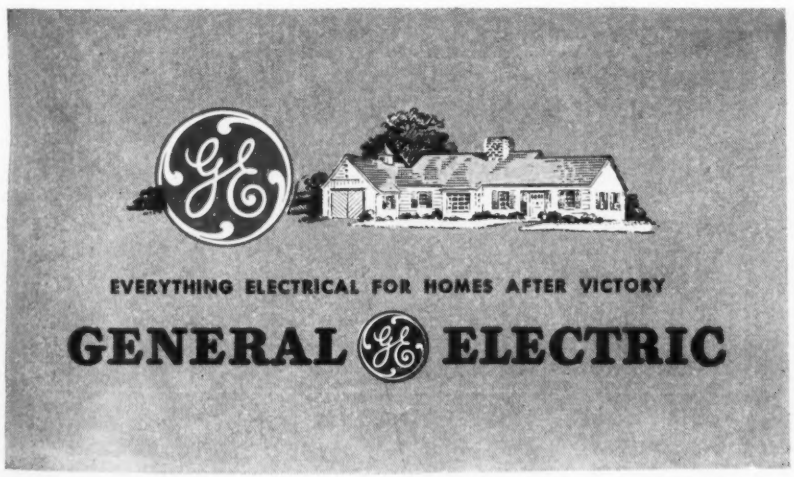
Reaching builders, architects, and bankers with special publication advertising; telling them why postwar homes should include complete electrical equipment.

Reaching rural and urban power users everywhere with appliance advertising that will total over 665,000,000 impressions in consumer magazines during 1945.

Utility Companies are playing a vital part in this program of consumer education. And General Electric has available helpful literature for almost any kind of promotion the utility may conduct.

Right now one of the strongest selling activities in the public education campaign is the G-E House Party. We will gladly furnish, without charge, interesting promotional material based on this radio program for mailing to your customers.

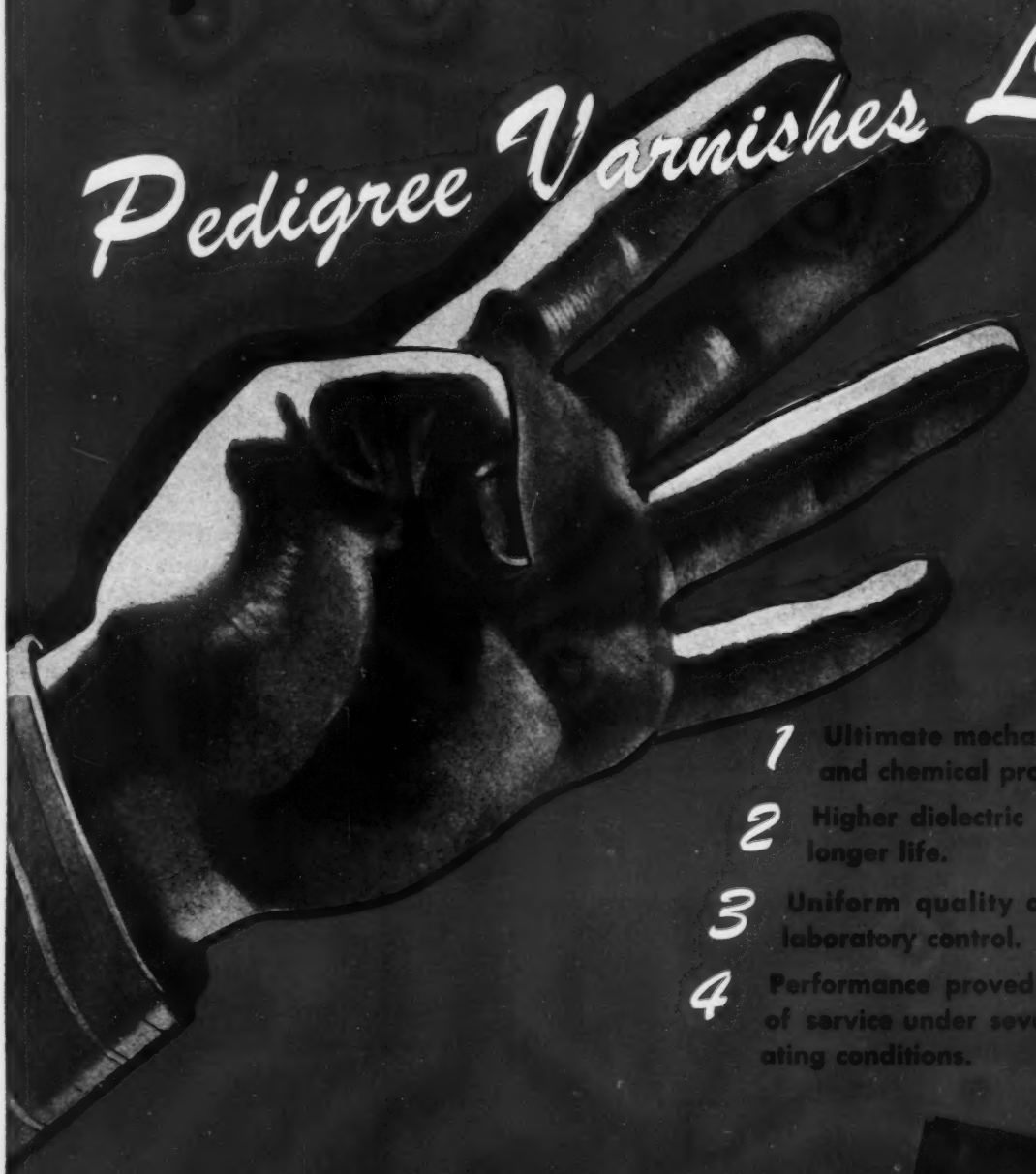
General Electric Co., Appliance and Merchandising Department, Bridgeport, Connecticut.



TUNE IN: "The G-E House Party," every afternoon, Monday through Friday, 4 p.m., E.W.T., CBS. "The G-E All-Girl Orchestra," Sunday, 10 p.m., E.W.T., NBC. "The World Today," News, Monday through Friday, 6:45 p. m., E.W.T., CBS.

FOR VICTORY—General Electric is working night and day to back the attack. You can help, too, by buying and holding more War Bonds than before.

4 GOOD REASONS WHY Pedigree Varnishes Lead



1 Ultimate mechanical, thermal and chemical protection.

2 Higher dielectric strength and longer life.

3 Uniform quality assured by laboratory control.

4 Performance proved by years of service under severe operating conditions.

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KEARNEY
PUL-TAB FUSE PAKS!

KEARNEY PUL-TAB FUSE PAKS save time and money because:

1. Individual bags prevent tangling and keep out dirt.
2. Visible identification tabs assure quick, accurate fuse selection.
3. You pull out only the fuse you need — the others are fastened and can't drop out.
4. Flat, compact package —5 links to a Pak— easy to stack or hook on lineman's belt.

KEARNEY FUSE LINK DISPENSER

The Right Fuse at The Right Place at The Right Time

Kearney visible Pul-Tab Fuse Paks save time and deliver a fresh, individually wrapped KEARNEY FUSE LINK for each job with assurance that its original precision has not been destroyed due to tangling, bending, dropping or other forms of rough handling or abuse.

A Kearney Fuse Link is handled just once—when it's needed to do a job!

***Figures show as high as 30% fuse link loss with old-time bulk packaging.**

JAMES R. KEARNEY CORPORATION

4224-4242 CLAYTON AVENUE . . . ST. LOUIS, MISSOURI

KLEINS
FOR MEN WHO WANT THE BEST
Demanding the best in tools and equipment has long been a tradition of the electrical industry. It is significant that linemen and electricians today rely on Klein Pliers—Klein Climbers—Klein Belts—Klein Safety Straps just as the pioneers in this field did when electricity was in the era of its first expansion.
To the man on the pole, the name Klein still means reliability plus a high factor of safety in the equipment he uses.
ASK YOUR SUPPLIER
Foreign Distributor:
International Standard Electric Corp., New York
This book on the care and safe use of tools will be sent on request
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Established 1857
Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

It covers the fundamental principles, differentiates between induction and dielectric heating, discusses types, sources of high frequency, design of heating coils, applications to brazing, soldering and joining, to hardening and heat treating, describes fixtures, enumerates miscellaneous applications, gives advice on designing for the application of induction heating to a manufacturing process and ends with some data regarding dielectric heating. It is decidedly a practical work, particularly valuable to the manufacturing executive, the designer, the maintenance engineer and the power salesman.

LETTERS

To the Editor:

Continuing the thought suggested in your editorial in the March issue of Electrical West entitled *Lesson in Semantics*, may I call your attention to the suggestion of Mr. W. B. Davis, Rochester, N.Y., as published on page 5 of the March 15 issue of *Forbes*. It reads as follows:

"In the interest of clarity and a better understanding on the part of all our citizens, I respectfully suggest that in all news items published in papers, magazines, editorials, etc., throughout the country, where reference is made to government projects, government expenditures, government-created jobs, etc., that the word TAXPAYERS be substituted for government.

"Possibly if this truth is repeated often enough it may finally penetrate, and the myth of a kindly, goodhearted something called government, dispensing, with generous hands, riches from a bottomless treasure chest, may be exploded, and we will finally realize what it is all about. Then if we prefer to pay and continue to pay, we will do it with open eyes, and not under the illusion that some man or group of men must necessarily be superior in intellect and endowed with the world's supply of the milk of human kindness."

C. E. Dyer.

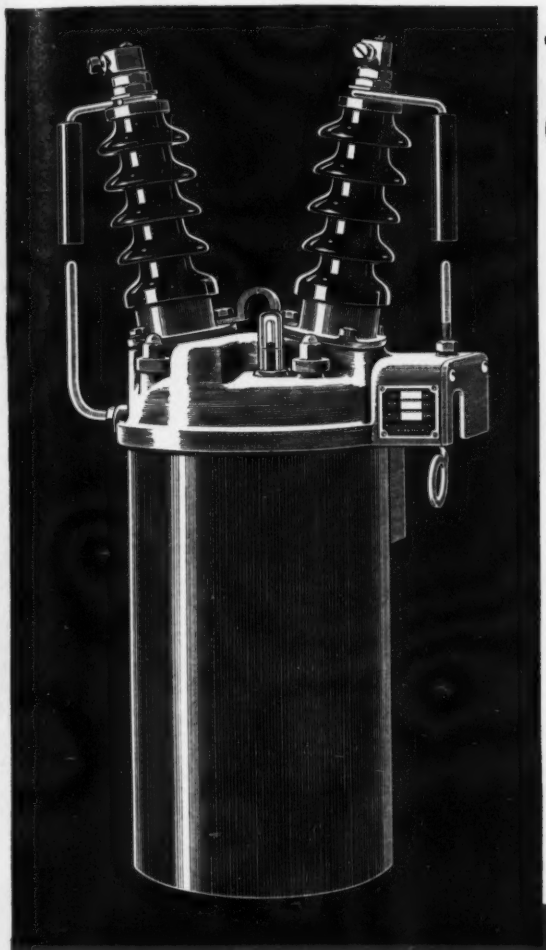
Santa Maria, Calif.

To the Editor:

I have just read your editorial *Why Ignore the Trolley Coach?* I am glad you are calling attention to the importance of the trolley coach to the electric industry and I think you are doing a good service to the riding public by expounding the merits of the trolley coach in public transportation. It is true that the trolley coach is a more expensive vehicle to construct than the gasoline bus. It is also true that the trolley coach requires the construction and maintenance of an expensive overhead, but on the other hand the trolley coach is today the most popular vehicle on the streets. It is more commodious than the motor coach and its operation is much smoother and absolutely noiseless. I think strict comparisons will disclose that the almost complete freedom from jerks in starting and stopping will reflect a considerable saving in accident hazards. Where distinct and heavy lines of permanent traffic have been developed, the trolley coach is the ideal vehicle and should be so recognized by the transit and the electrical industries.

Franklin T. Griffith,
Chairman, Portland Traction Co.

Portland, Ore.



This is the way KYLE Automatic Oil Circuit Reclosers Operate

- To Decrease Outages
- To Reduce Maintenance
- To Increase Continuity of Service

Rural distribution systems with their long lines and small loads scattered over large areas depend, for their economical operation, on low cost of installation, minimum cost of maintenance, and maximum continuity of service.

Kyle Automatic Oil Circuit Reclosers provide the perfect protection for such lines. This Recloser has the advantages of minimum time delay opening on the first and second operations to clear all transient faults on the protected sector. It also gives greater time delay opening on the third and fourth operations to allow the blowing of a sectionalizing or transformer fuse to isolate a permanent fault without locking out the Recloser.

Thus, the Kyle Recloser permits the clearing of 85% of all faults which occur on rural systems and restores service completely as soon as they are cleared. It isolates the permanent faults to the smallest possible localities.

This ability of Kyle Automatic Oil Circuit Reclosers to coordinate with fuse links greatly decreases the number of outages, eliminates countless service trips, reduces maintenance costs and provides the greatest possible continuity of service.

TIME CURRENT VALUES OF KYLE RECLOSER OPERATION

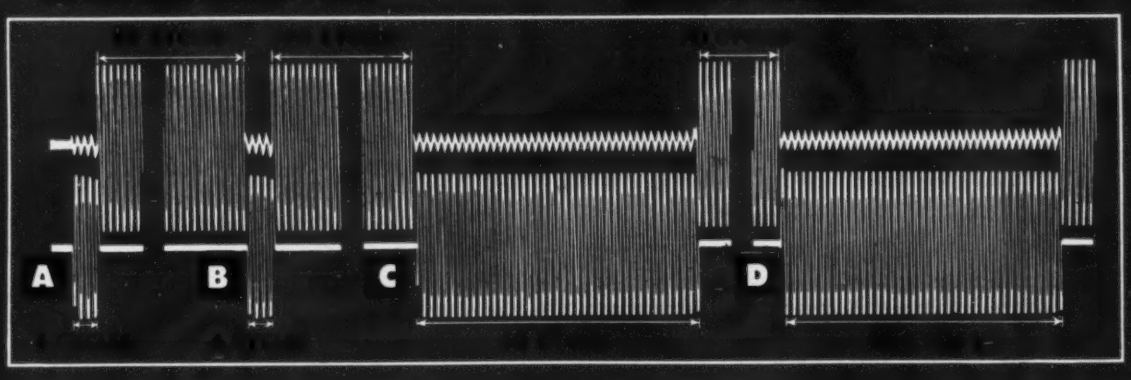
This oscillogram gives a graphic picture of the time current values obtained in a single interruption of a 5 Ampere Type "H" Kyle Automatic Oil Circuit Recloser taken at 2400 volts with a current of slightly over 20 amperes and a power factor of 82.5.

A **FIRST OPENING:** Time required to open: 4 cycles; time delay before reclosing: 42 cycles.

B **SECOND OPENING:** Time required to open: 4 cycles;

C **THIRD OPENING:** Time required to open: 40 cycles; time delay before reclosing: 75 cycles.

D **FOURTH OPENING:** Time required to open: 40 cycles;

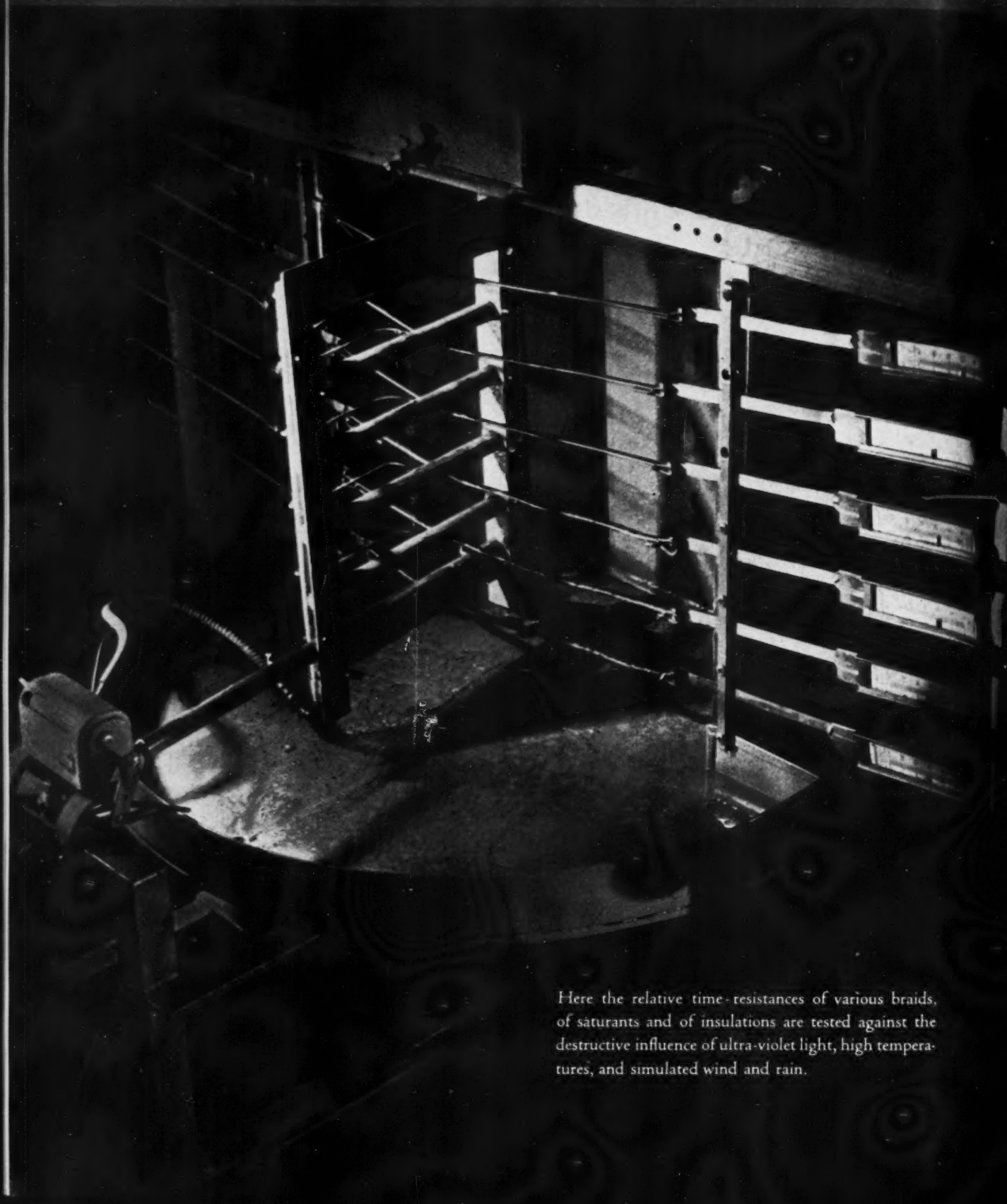


Ask your Line Material Representative to give you full information on the specific application of Kyle Automatic Oil Circuit Reclosers to your lines.

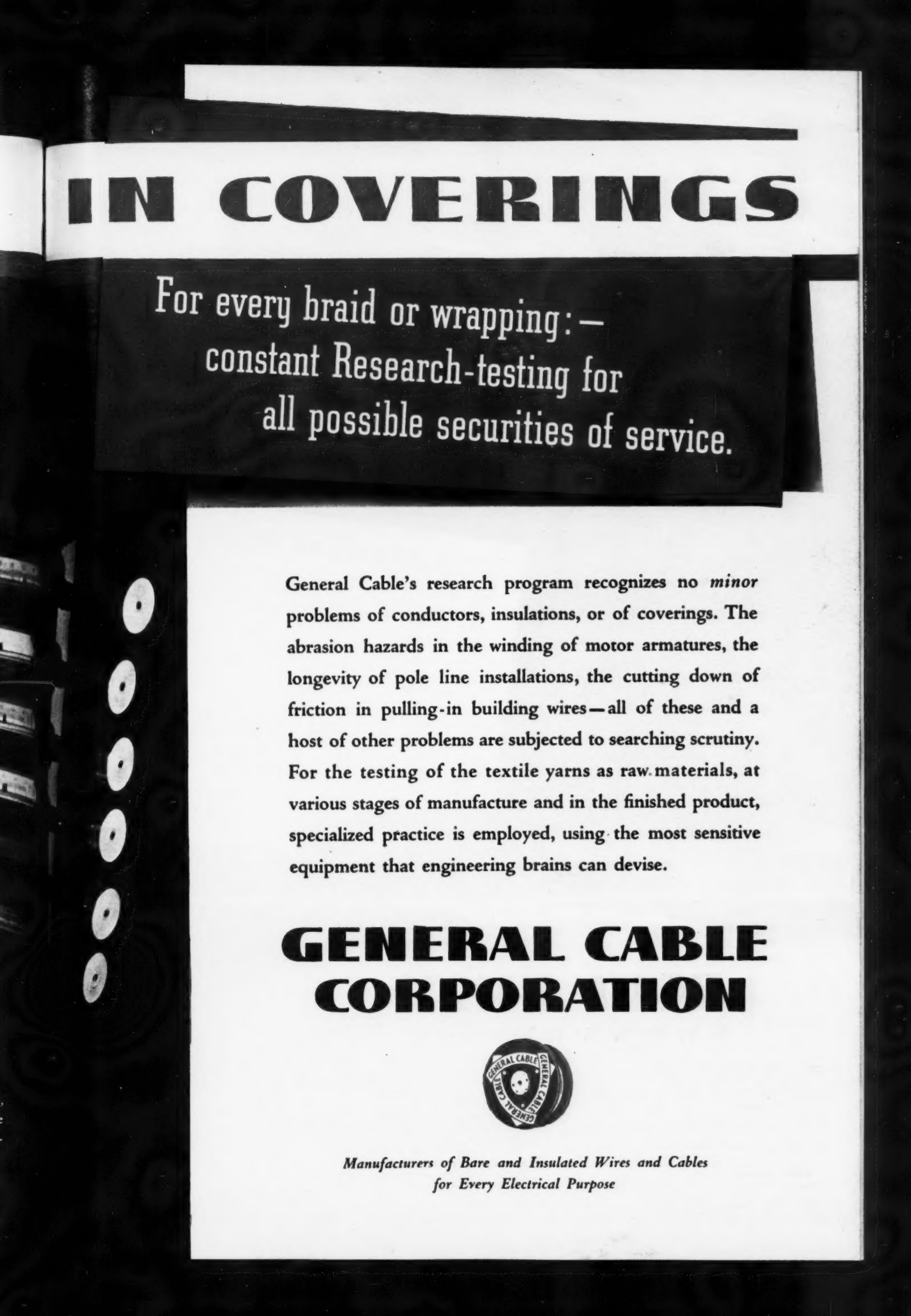
MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

KYLE Circuit Reclosers are designed and manufactured for LINE MATERIAL COMPANY

ENDURANCE



Here the relative time-resistances of various braids, of saturants and of insulations are tested against the destructive influence of ultra-violet light, high temperatures, and simulated wind and rain.



IN COVERINGS

For every braid or wrapping:— constant Research-testing for all possible securities of service.

General Cable's research program recognizes no *minor* problems of conductors, insulations, or of coverings. The abrasion hazards in the winding of motor armatures, the longevity of pole line installations, the cutting down of friction in pulling-in building wires—all of these and a host of other problems are subjected to searching scrutiny. For the testing of the textile yarns as raw materials, at various stages of manufacture and in the finished product, specialized practice is employed, using the most sensitive equipment that engineering brains can devise.

GENERAL CABLE CORPORATION

Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

BLAW-KNOX and the voice of radio

Blaw-Knox Towers have played an important part in radio since the early days of Marconi. Most Radio Towers*, here and abroad, are of Blaw-Knox design or manufacture. Blaw-Knox's importance in military electronic development cannot now be disclosed.

What Blaw-Knox means to radio, it means to many other industries. If you are concerned with modern methods for converting raw materials to usable products by chemical or mechanical means, or solvent recovery . . . or any ramification of industrial processing, Blaw-Knox can carry on from pilot plant to full scale production.

Blaw-Knox can serve in other ways: with prefabricated piping, equipment for the steel industry and a broad line of construction equipment, to name a few. Let us discuss your problems with you—at your convenience.

*The Tower is an essential part of the voice of radio. Blaw-Knox Towers (some over 1000' high) are used for broadcasting, communications, navigation, television, facsimile, police work . . . as well as for unidisclosed electronic purposes.

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A FEW VICTORY PRODUCTS

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STANDARD ENGINEERS NOTEBOOK

VOL. 2-E No. 3

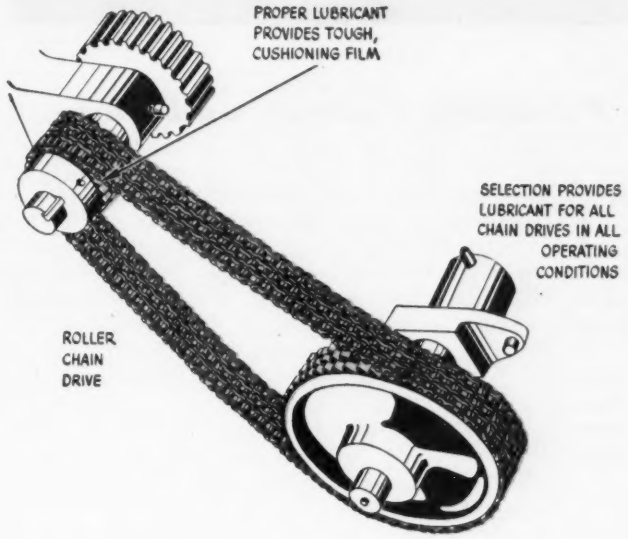
Correct lubricant reduces chain drive wear

Selection of the proper Calol lubricant for any type chain drive will materially reduce wear even under the most adverse conditions.

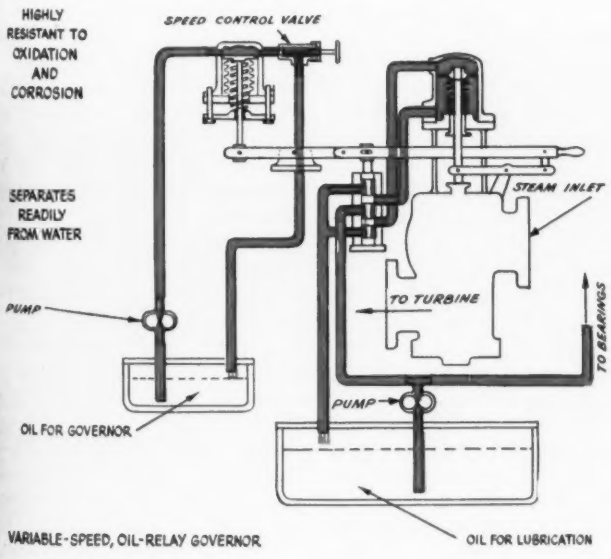
On a worm or exposed roller and block chain, Calol Pinion Grease—0 is recommended for high operating temperature, Calol Roller Oil—X for medium and Calol Journal Oil—135 for low. For enclosed chains of this type, Calol Journal Oil—165, —135 and —35.

For chains exposed to pitch, resinous materials, etc., special Calol Drier Chain Oil is recommended.

Recommendations for silent chain drives are as follows: Worn, exposed chains: Calol Roller Oil—X, high temperature; Calol Journal Oil—135, medium temperature; Calol Journal Oil—35, low temperature. New, exposed chains or oil-bath-lubricated encased chains: Calol Journal Oil—135, —35 and —25. Splash-lubricated, encased chains: Calol Journal Oil—35, —25 and —14.


PROPER LUBRICANT PROVIDES TOUGH, CUSHIONING FILM
SELECTION PROVIDES LUBRICANT FOR ALL CHAIN DRIVES IN ALL OPERATING CONDITIONS
ROLLER CHAIN DRIVE

Inhibited turbine oil lengthens charge life



Many operators have eliminated rust, gum-carbon and sludge trouble in hydraulic governors and turbine oil-systems by using Calol OC Turbine Oil.

Made from highly refined, high viscosity index base stocks, Calol OC Turbine Oil is compounded with extremely effective oxidation and corrosion inhibitors. Because of high oxidation resistance, charges of this oil may be used much longer than charges of ordinary turbine oil. It prevents rust formation, particularly troublesome during the initial operation of turbine units, assures maximum lubrication safety and a minimum of time lost for maintenance.

Although it is primarily made for steam turbine lubrication, Calol OC Turbine Oil is adaptable to other operations where there is need for a high grade oil that will not deteriorate rapidly in the presence of high temperatures or moisture.

Calol OC Turbine Oil is made in five grades: —5, —9, —11, —15, and —19.

Standard Fuel and Lubricant Engineers are always at your service. They'll gladly give you expert help — make your maintenance job easier. Call your Standard Representative or write Standard of California, 225 Bush St., San Francisco 20, California.

STANDARD OF CALIFORNIA

ELECTRA'S HUSBAND

President Truman and Power

"FDR never was a friend of the power companies, was he?" Electra asked as we sat listening to the radio eulogies on the day of the Hyde Park funeral services. "I wonder why?"

"It doesn't matter much now," I answered, "except insofar as his fundamental reasons and philosophy continue to be reflected in top government. His partisanship stemmed from the so-called liberal doctrinarians for whom he served as spokesman. Now that he is out of the picture, it's what they do and where they go that interests the power people."

"You mean people like Secretary Ickes and Congressman Rankin and a lot of their followers?" she queried.

"Yes, and the emphasis is on the followers," I said. "They are the backbone of a large group whose members are variously labeled 'government power zealots' or 'proponents of a federal power bureaucracy'."

"That's not what I've heard some of your power company friends call them," Electra interrupted.

"They've been called a lot of names and with good reason," I said. "But the fundamental thing is what happens to them in President Truman's administration. If they are to have the same free rein as they did under the New Deal, then there isn't much relief in sight. If their power and their appropriations are curbed, then there is some likelihood that the relationship between the electric industry and the government can be rationalized with some degree of harmony."

"You bank a lot on President Truman, don't you?" she asked. "How does he think when it comes to government power?"

"He has made two significant announcements. In the first he said that he would defend the ideals of President Roosevelt. Then in his press conference, he gave the government power projects a pat on the back. However, my feeling is that his feelings go deeper than either of these pronouncements would indicate. President Roosevelt defined his fourth term as an administration that would go 'a little left of center.' Those who know President Truman say his convictions lie a little right of center."

"How about his record?" Electra asked.

"Business and industry need have no fear of it," I answered. "That statement is based upon the work of his Senate War Investigating Committee. He did a sound and thorough job as chairman of that important body. He drew together a really bi-partisan group of senators, and he established a strong, conservative staff. During the entire time he was head of this powerful committee, not a single case of muck-raking or witch-hunting occurred. Instead he made the committee a power to be feared among manpower and money wasters, whether they were in the government or in business. It is also significant that the members of the Senate unanimously approved every single report of his committee."

"I remember how the papers praised the work of his committee," Electra said.

"He is opposed to government waste and he is opposed to centralized government," I continued. "A lot of the government power projects are involved in programs that contemplate both. Moreover, he's a Middle Westerner. What was it he said about his new responsibilities?"

"'Did you ever have a bull or a load of hay fall on you?'" said Electra quoting. "When he said that, I think maybe he answered my questions about him. Time will tell."

ELECTRA has been asking the real significance of the plans for establishing a Columbia Valley Authority in the Pacific Northwest and a Missouri Valley Authority which will take in some of the Mountain States. She was wondering about the social benefits which the sponsors of these proposals promise. She remembers seeing that subtle propaganda motion picture, *The River*, and she has read much about the Tennessee Valley Authority, most of it pretty smooth propaganda also. She has been impressed favorably and has been skeptical of my contention that the whole regional authority program involved other issues than government ownership of electric power or the coordination of power, flood control, navigation, irrigation, forest and soil conservation. I've convinced her now, and the argument which did it was a recitation of the activities carried on by the TVA which are only remotely related development of the benefits from our water resources.

Here are some TVA enterprises which ought to surprise and shock some of the Congressmen who voted for the legislation creating that governmental body TVA has:

Instituted a super government, superior to the state and local authorities.

Taken over certain police powers.

Engaged in the manufacture of the following: Fertilizer, ammonium nitrate, calcium carbide, phosphorus, decalcium phosphate, calcium silicate, dehydrators, alumina, laminated wood.

Directed operations on a large area of farm land.

Promoted food processing and marketing associations. Processed fish.

Constructed and operated river terminals.

Operated flood control facilities.

Operated a malarial control plan.

Operated farm lands.

Engaged in lumbering.

Operated recreational facilities including tourist cabins.

Engaged in such social work as readjusting families.

Built and rented houses.

Produced and sold electric power.

Regulated electric rates of re-sale customers.

Lent money. Quarried limestone.

Done engineering work outside TVA territory including some in Russia.

Experimented with socialized medicine.

Carried on a wide variety of research, some of which is outside TVA.

Operated grocery stores and service stations. Operated schools.

Operated a domestic water supply system. Operated drug stores.

Directed forestry, commercial, agricultural and health activities.

Directed a plan for the unified development of the area, including moving industries in other areas to the TVA territory.

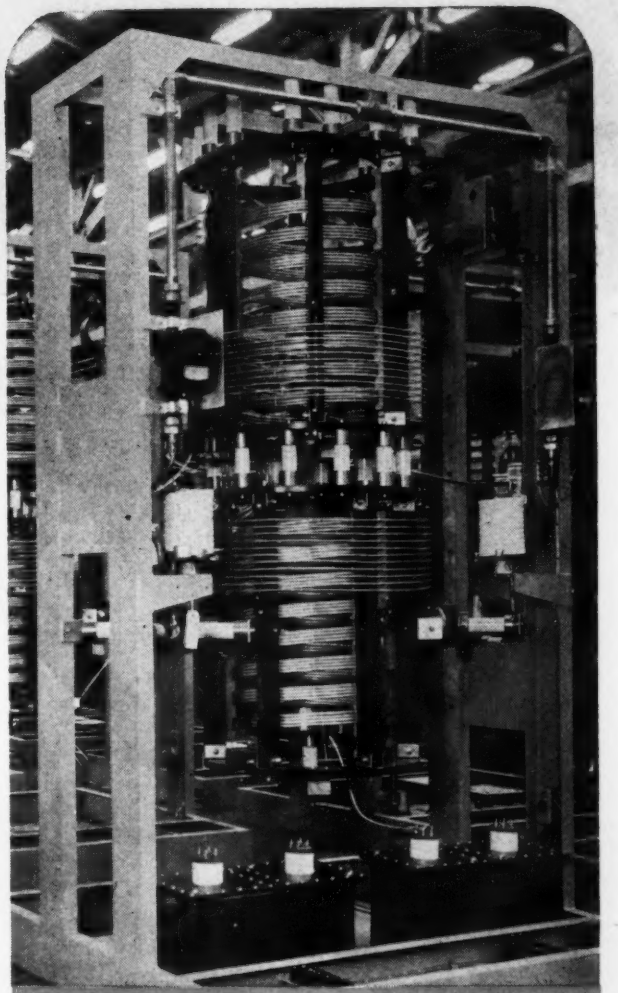
When she studied these activities—almost all of which are in direct competition with private enterprise—Electra was inclined to agree with Dr. Arthur E. Morgan, original chairman of TVA, when he recently said:

"Unless we straighten out our thinking in the matter of 'authorities,' and decentralization and regionalism, we shall drift into a state of confusion in national administration which will make our government good hunting ground for irresponsible bureaucrats."

Because of the basic importance of adequate wiring to the entire electrical industry, Anaconda is presenting messages like this in a wide list of national publications.

It's a High-Powered Induction Heating Source-

YOU'LL WANT THE PRODUCTION ADVANTAGES OF EQUIPMENT LIKE THIS—
BUT—IS YOUR ELECTRICAL WIRING PLANNED TO CARRY THE LOAD?



Westinghouse

In this working component of a high-powered induction-heating unit, brief applications of relatively large amounts of power heat metals from within. Heat distribution is quick, uniform.

New, efficient equipment of every kind promises tremendous postwar production advantages. Don't let lack of electrical capacity bar you from such opportunities.

Make sure your wiring plans are based on *future* needs, not *past* experience. Remember, rush teardowns for alterations will be costly. Wire ahead!

Now is the time—while you're in the planning stage—to call in your consulting or plant power engineer, electrical contractor or power salesman. They'll agree *foresighted* wiring will cost a lot less than the "wait and see" kind. 45288

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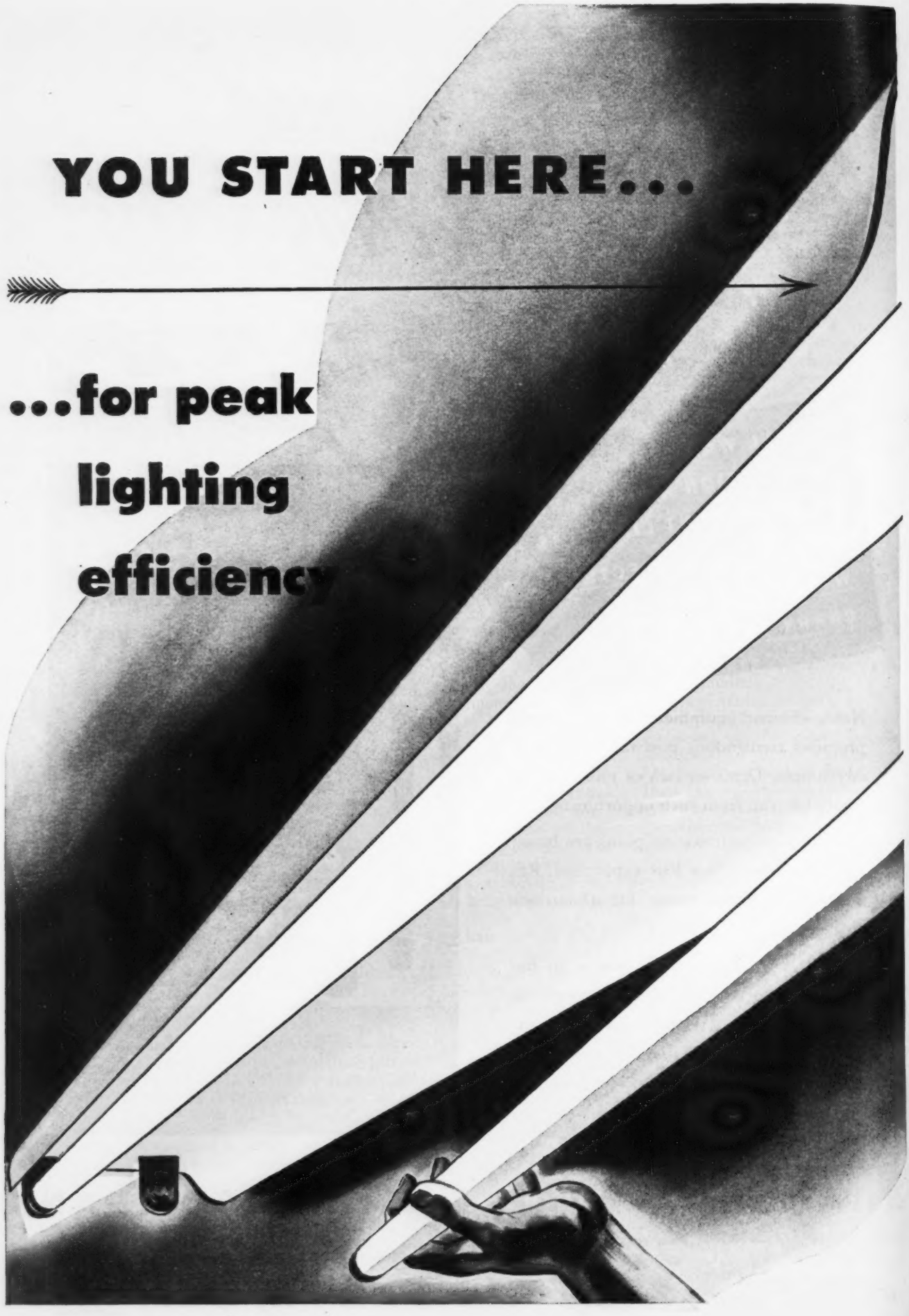
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...for peak
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The best lighting system is no better than its lamps —and no lamps are better than Westinghouse.

Their efficiency is outstanding because

- research never stops
- raw materials are the best obtainable
- manufacturing technique has been refined to the highest degree
- testing and seasoning assure top dependability.

These are the reasons why Westinghouse Lamps are prime business builders. Just as they bring out the best in any lighting system so they will produce sales—real prestige business—the kind that lasts. Westinghouse Electric & Manufacturing Co., Bloomfield, N. J.

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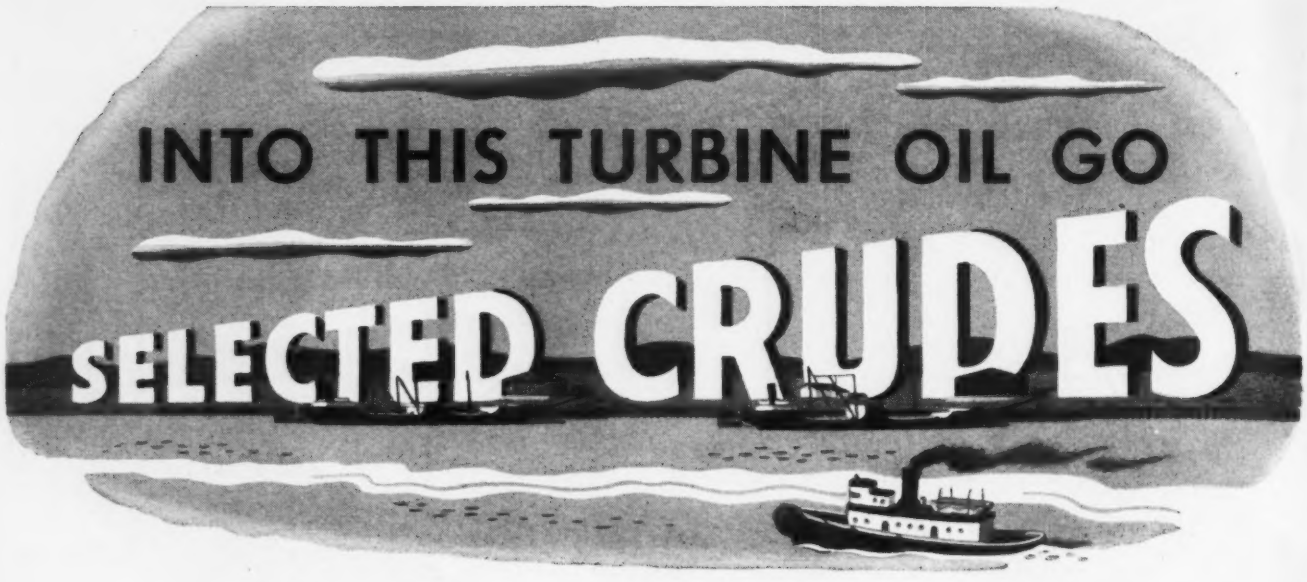
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

MAZDA LAMPS FOR SEE-ABILITY



From the ground up, Shell Turbo Oil (Inhibited) is selected, refined and fortified to give faultless turbine performance

This is not just ordinary lubricating oil "doped" for turbine use.

Starting with a crude oil especially selected for turbine lubrication, Shell refines it by a solvent extraction process to enhance the oil's inherent stability and demulsibility.

Next, the oil is fortified with Shell-developed additives . . . special ingredients which have put it in a class by itself. An anti-oxidant additive is introduced, greatly increasing the oil's naturally high oxidation resistance. Then, to give exceptional rust-preventing quality, Shell adds another compound which assures both maximum metal-covering ability and high film strength.

Painstaking care in selection of crude stocks, refining and compounding pays off for users of Shell Turbo:

Shell inhibited turbine oils have shown little or no trace of OXIDATION *after years of service in marine, industrial and public utility installations. They have completely prevented* RUST FORMATION, *resisted* STRUCTURAL BREAKDOWN *over similar periods — far surpassing the performance of replaced oils.*

For dependable turbine lubrication, rely on Shell Turbo . . . the inhibited oil with the anti-oxidation and anti-rust additives. Shell Oil Company, *Incorporated.*

Oil is Ammunition
. . . use it wisely

SHELL TURBO OIL
(INHIBITED)

Shellengineered for the job

ELECTRICAL WEST

MAY, 1945
VOL. 94 NO. 5

RUNOFF AND STORAGE PROSPECTS—1945

THE WEST as the country's principal source of hydroelectric power production is vitally concerned with each year's supply of water in its streams and reservoirs and in the winter snow crop from which a major part of that water comes. April snow surveys indicate that, this year, runoff will be below the average of the past ten years in most parts of the West, but reservoir storage will be generally above average.

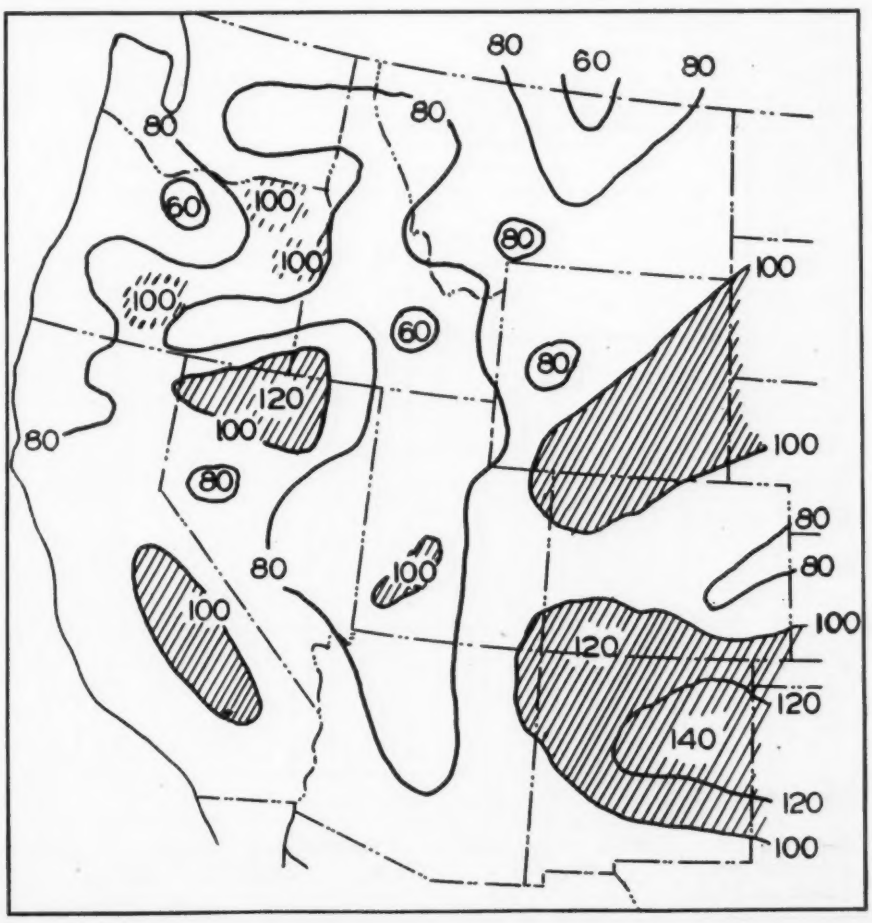
Power companies, in common with a long list of other water users in the eleven Western States, ranging from municipalities to irrigation farmers who look to the high mountain watersheds for their water, have come to rely more and more upon advance snow survey and water forecasts as helpful indicators of probable stream flow and reservoir storage. Though these forecasts are based upon expected rainfall during the April-September season and may be upset by abnormally high or low precipitation, the forecasters, headed by the U. S. Department of Agriculture's Soil Conservation Service, hold a record of increasing accuracy over the years since this service has been provided.

Exacting care with which the snow surveys are made and with which these and other water data such as stream gauge measurements are put together for the final predictions account for their general dependability within the summer climactic limitations. For years snow surveys, to meet their own requirements, were made independently by power companies, municipalities, state engineers and others. It was back in 1900 that the importance first was recognized of measuring the snow for its water content rather than just its depth, because snow is a mixture of water and air,

Prepared by the Division of Irrigation, U. S. Soil Conservation Service, from data furnished by Federal, State, and private cooperative snow survey networks in Western States.

and a given depth of snow may vary widely in the amount of water it contains, depending upon temperature and other factors.

Today approximately 1,000 men travel about 20,000 miles each winter into the West's high mountain watersheds to take these important measurements. A cooperative undertaking, the snow surveying is carried on by many different groups and agencies—power companies, municipalities, National Park and U. S. Forest Services, irrigation districts, Geological Survey, Indian Service, Fish and Wildlife Service, Bureau of Reclamation, Soil Conservation and others. The information is assembled by the Soil Conservation Service — a responsibility with which it has been charged since 1935—and detailed reports and forecasts are rushed to interested water



Prospective stream flow April-September 1945 in per cent of average. Shaded portions indicate above average flow

A watershed near Lake Aneroid snow course in the Wallowa Mountains, Ore.

users, though some states also handle their own reports.

The surveys are made near the turn of the month, from once to several times each winter, depending upon how difficult it is to reach certain snow courses. Reports are issued from January to May, inclusive, the April report being the most important because it usually records the maximum snow cover for the year before melting has started.

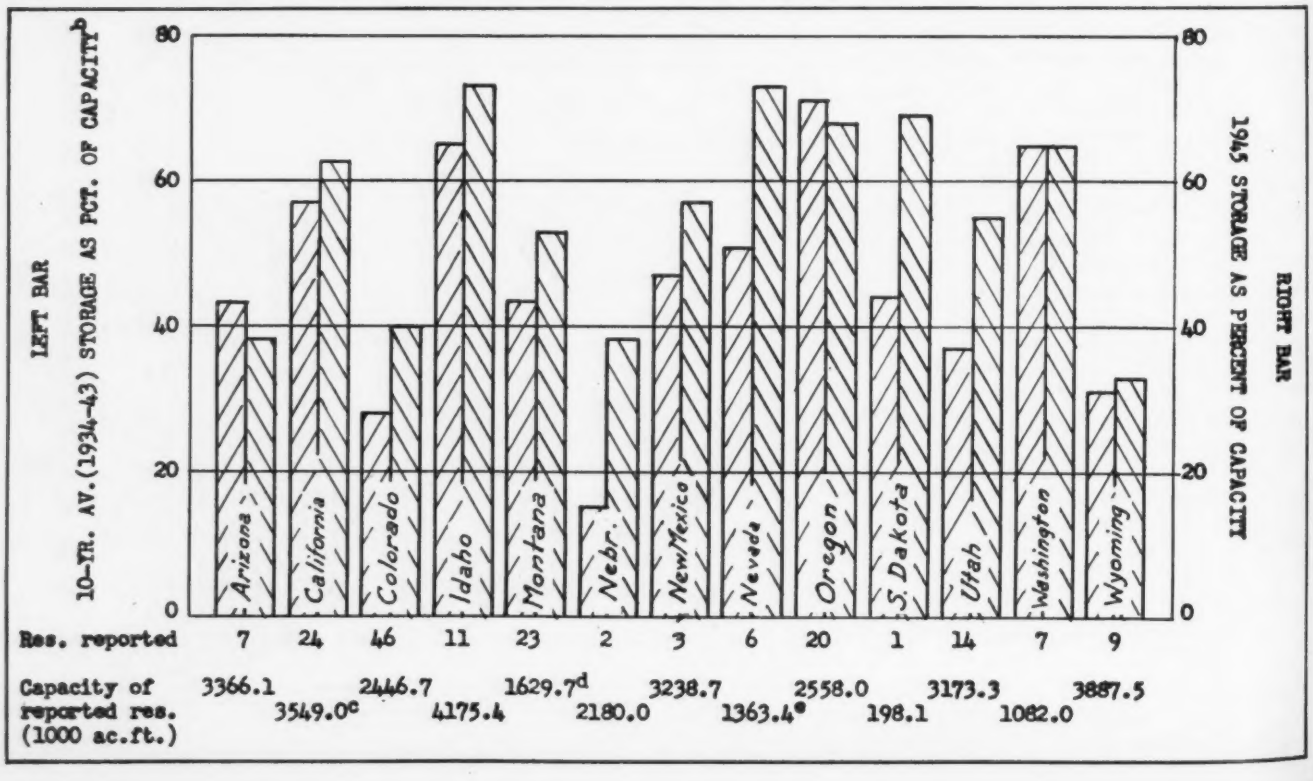
In April, too, stream gauge measurements and other available information as to stream flow, existing reservoir storage, ground water conditions and the like are set down alongside the snow survey figures themselves; and from this information, formal stream flow and reservoir storage forecasts for the coming season are issued. The Columbia Basin Water Forecast Committee meets each year in Portland in April and prepares the final forecast for the basin from British Columbia southward. This year, for the first time, a companion forecast meeting for the Southwest was held in Los Angeles.

Some 850 Western snow courses, carefully located usually in mountain meadows to assure undisturbed snow cover to measure, are visited by the surveyors, who travel in pairs as a precaution in coping with hazards such as snowslides and storms. Each course is marked with a number of permanent "stations," and every snow sample is taken at the same point each time, alongside the steel pole, set in concrete and bearing the official snow course sign that marks each station.

The snow sample itself is taken with an assembly of hollow, lightweight metal tubes, pushed all the way down to the soil beneath the snow. The tubes, graduated in inches, have slits through which may be seen the height of the snow column, thus giving its depth reading. The snow core then is weighed on a special hand scale, graduated so as to give the reading in inches of water. The snow courses always are located in major storm paths, in order that the year-by-year measurements will provide representative information concerning the snow cover in the particular watershed.

The following paragraphs summarize the prospects for 1945 runoff and storage, both as related to ten-year averages. The storage percentages represent major reservoirs for which ten-year records are available, and are in

RESERVOIR STORAGE AS OF APRIL 1, 1945. Not all reservoirs in all states are reported, but enough are reported to give a reliable index of each state's storage supply. Explanation: b—Most state averages for reported reservoirs are for full ten-year period, but in a few cases reservoirs having shorter records are included. c—Does not include Narrows (Yuba River), Friant or Shasta reservoirs. April 1 storage in these three reservoirs combined is 3,020,200 acre-ft., which is 72% of their capacity. d—Does not include Fort Peck reservoir (capacity 19,000,000 acre-ft.). April 1 storage, 11,160,000 acre-ft. e—Does not include Lake Mead (capacity 31,140,000 acre-ft.). April 1 storage 21,236,000 acre-ft.



terms of storage capacities.

Arizona—Runoff is expected to be sub-average, ranging from about 70% of the average for Gila River to 80% for Salt and Little Colorado rivers. Storage is about 38% of reservoir capacity. The ten-year average storage is 43% of capacity. The 1945 storage is about 88% of ten-year average storage.

California—Runoff will approach the average, ranging, by major Sierra basins, as follows (north to south): Pit, 91% of average; Feather, 78; Yuba, 85; American, 88; Mokelumne, 96; Stanislaus, 98; Tuolumne, 106; Merced, 101; San Joaquin, 101; Kings, 100; Kaweah, 106; Kern, 104. Storage, as represented by 24 reservoirs over ten years old, is 63% of reservoir capacity. Average storage in these reservoirs is 57% of capacity. The 1945 storage is 111% of the ten-year average.

The 24 reservoirs represented by the preceding storage percentages do not include reservoirs recently created by Narrows (Yuba), Friant and Shasta dams. The present storage in 27 reservoirs, including these three, is 68% of capacity.

Colorado—Runoff will be about the same as the ten-year average, ranging by major basins, as follows: Poudre, 85% of average; South Platte, 85; Arkansas, 80; Purgatoire, 95; Rio Grande, 105; Animas, 120; Dolores, 100; Gunnison, 100; Upper Colorado, 95; White, 118; Yampa, 107.

Storage totals about 40% of reservoir capacity. Average is 28% of capacity. The 1945 storage is about 145% of the average storage.

Idaho—Runoff will be substantially below average, ranging as follows: Kootenai, 89; Clark Fork, 76; Spokane, 71; Clearwater, 92; Salmon, 76; Weiser, 111; Snake (at Weiser), 81; Payette, 72; Boise, 82; Big Wood, 61; Big Lost, 74; Snake (at Heise, Ida.), 93; Snake (at Moran, Wyo.), 91.

Storage is 73% of capacity. Average is 65% of capacity. The 1945 storage is 113% of average storage.

Montana—Runoff will be sub-average, ranging as follows: Marias, 90% of average; Milk, 55%; Musselshell, 83; Jefferson, 87; Madison, 72; Gallatin, 87; Yellowstone, 80; Tongue, 100; Kootenai, 89; Clark Fork, 76.

Storage is 53% of reservoir capacity. Average storage is 44% of capacity. The 1945 storage is 122% of average storage. Fort Peck reservoir on April 1 held 11,160,000 acre-ft., or 59% of capacity, as compared with 1944 storage of 10,120,000 acre-ft., or 53% of capacity.

Nevada—Runoff will be above average if gauged by April indications for Upper Humboldt and Little Humboldt, which were, respectively, 120 and 127% of average. Records for other basins are shorter than ten years, but as compared with 1944 runoff, Steptoe Valley shows a percentage of 102, Baker Creek 119, and Mt. Charleston 158. A percentage of 350 for Reese River is based on partial survey.

Rye patch reservoir on Lower Humboldt is filled to its capacity of 178,100 acre-ft., this representing 421% of the average storage since completion of construction in 1936. Six major storages are at 73% of capacity, as compared with 51% as an average. The 1945 total is about 145% of the average. Lake Mead held 21,236,000 acre-ft. on April 1, or 68% of capacity.

New Mexico—Runoff will exceed the ten-year average, as follows: San Juan, 105%; Chama, 110; Canadian, 130; Pecos, 140. Storage is 57% of capacity as compared with a ten-year average of 47% of capacity. The 1945 storage is 120% of average.

Oregon—With few exceptions stream flow is expected to be below average, but in most cases not seriously so; 93% of irrigated lands have good to fair water supplies in sight. Storage is 68% of reservoir capacity, as compared with a ten-year average of 71% of capacity. The 1945 storage is 95% of the ten-year average. While 6% greater than last year, the total is 14% less than in either 1943 or 1942.

Utah—Principal watersheds show a water content in snow storage closely equal to the average of the last ten years. Eastern Utah is somewhat short, as is northern Utah. There will be no critical shortage of water in any area. All storage reservoirs will fill, except Utah Lake and Bear Lake, both of which hold enough water to meet the demands of several seasons.

Washington—Runoff will be slightly sub-average, as follows: Columbia at Birchbank, B.C., 95%; Columbia at The Dalles, Ore., 88; Chelan at Stehekin, 82; Chelan at Lucerne, 90; Okanogan, 94; Methow, 97; Wenatchee, 73; Yakima, 68. Storage in percentage of reservoir capacity is the same as the ten-year average—65%.

Wyoming—Runoff will closely approach the ten-year average, major basin percentages being as follows: Shoshone, 96; Powder, 98; Belle Fourche, 100; Wind, 75; Sweetwater, 100; Green, 100; North Platte, 100; Laramie, 100. Storage is slightly greater (104%) than the ten-year average, being 33% of reservoir capacity; the ten-year average is 31%.

A. E. Kenworthy, Forest Service ranger, and R. A. Work, USDA Soil Conservation Service, record snow measurements

Light and Power for Skyliner Building

Extremely high and wide spans of floating structure require novel flexible installation for twin-unit incandescent lighting system

A BUILDING so big that it has to float in order to accommodate its expansion and contraction, calls for some unusual handling of the electrical job as well. The new subassembly and final assembly plant, building 309, plant B6, of Lockheed Aircraft Corp. at Lockheed Air Terminal, Burbank, Calif., is such a structure.

As aircraft grows bigger, it takes larger quarters in which to manufacture it. Moreover the space must be clear of pillars or obstructions—spanned by unusually long trusses at high elevations. In this nest for hatching out even bigger airships than Lockheed's already huge "Constellation," the structural span is 252 ft. across and the height above floor level is 62 ft. To accommodate expansion and contraction, such spans are mounted on pins, 8 in. thick, at each side, at floor level, with a center pin joining the two half sections at the top.

Naturally such equipment as is anchored to the concrete floor must be joined to this floating structure in a way to allow movement. Since most equipment is electrically driven and since for convenience the raceways for serving electricity to such equipment must be affixed to the structure, this calls for unusual technique.

Add to it the requirement in the specifications that no holes were to be drilled in any of the steel for support of any conduit or wireways and the problem confronting the installing electrical contractor required ingenuity in devising supporting clamps and fittings.

West side of the building at night with its three banks of floodlights

The Lighting

Lighting from such an elevation likewise must be delivered with a punch to reach the working level in any appreciable quantity. So an incandescent lighting system was employed for this particular plant, with satisfactory result. So many aircraft plants lately have been fluorescent lighted that this selection of light sources itself is of interest.

Actual lighted area measures 252 ft. wide by 406 ft. in length. The over-all building dimensions are 301 by 406 ft. Incandescent lighting is used throughout the manufacturing and assembly area and fluorescent lighting in the mezzanine areas. The mezzanine areas house the shops, offices and some of the small subassemblies and drafting room. There are three floors of mezzanine with a balcony at each level and space is available for two more in the future.

The incandescent lighting consists of a total of 231 Benjamin twin, high-bay, porcelain enamel reflector units, using 1,000-watt P.S.-52 inside frosted lamps. These units are mounted on special designed support brackets from the catwalks. Bottom edges of reflectors are 61 ft. above floor level.

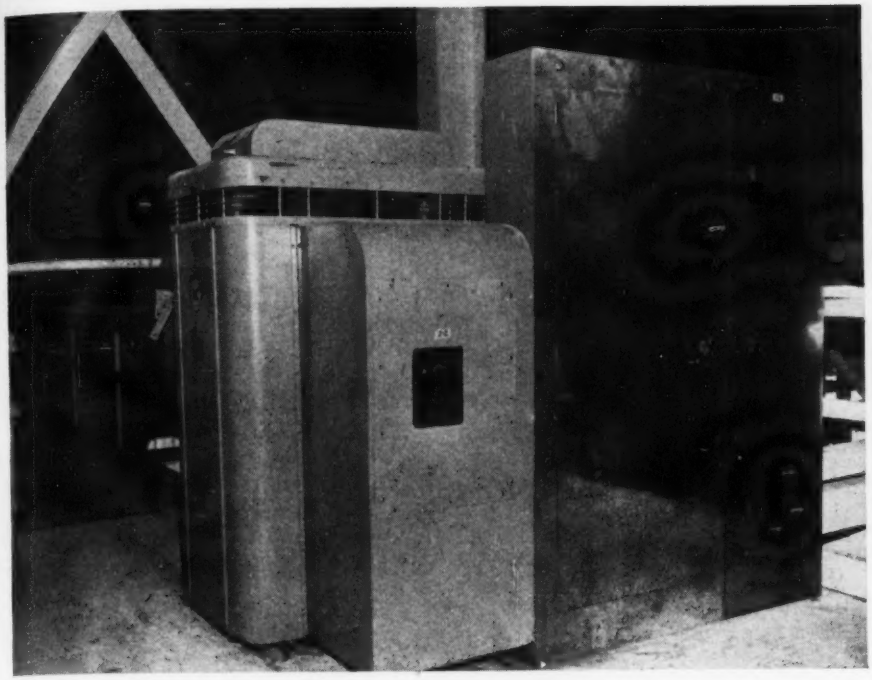
The twin reflector assembly is supported on a Benjamin adjustable hanger, which allows the reflector assembly to be swung up to the catwalk for servicing and relamping.

Twin reflector units are spaced on 18x21-ft. centers. The lighting measures an average of 50 foot-candles on a horizontal plane, 3 ft. above floor level. Vertical illumination measures 25 foot-candles on a vertical plane 5 ft. above floor level.

Selection of the incandescent, por-

Twin reflectors on flexible mounting at catwalk floor level can be pulled up to the catwalk for maintenance

Easy access to each unit is thus provided maintenance men to relamp or to clean the fixture in utmost safety



One of the unit substations on its platform in the roof trusses. The transformer bank is at the left and the panelboard containing contactors for the lighting circuits on the right

celain enamel, high-bay reflector was made on several factors. Among these were the lower first cost of the installation, which could be amortized more quickly. Another factor was that it was not contemplated to do much close work on shiny aluminum in the main area, and therefore the specular reflection from the incandescent point sources is not anticipated as a serious factor. The matt surface of the porcelain enamel, with its permanency and ease of cleaning and maintenance, were also important in the selection.

Where close work is likely to be done on shiny metal, in the shop and along the benches in the mezzanine area, fluorescent lighting units are used. These are Smoot-Holman industrial units containing two 40-watt lamps each. Usually these are arranged in three rows across on 7x8-ft. centers and produce 40 foot-candles on the working plane. If higher intensity is needed for close work, more units can be added since the circuits are only loaded at 900 watts per circuit and are protected by a 20-amp. multibreaker.

Wiring for the twin reflector units is on circuits of 4,000 watts and controlled by 50-amp. Westinghouse quicklag breakers. Branch circuit wiring is No. 6 rubber-covered wire to the outlet box with No. 12 asbestos type wire carried to each twin unit reflector socket. Voltage drop is less than 2%.

The lighting is supplied by three air-cooled unit substations, rated 150 kva. each, mounted on platforms in the roof trusses. Each substation unit serves approximately 77 twin reflector units. Lighting control is remote through the substation contactor panels. Lock switches for the lighting are placed where required at floor level. These energize the contactors which in turn switch on the lighting.

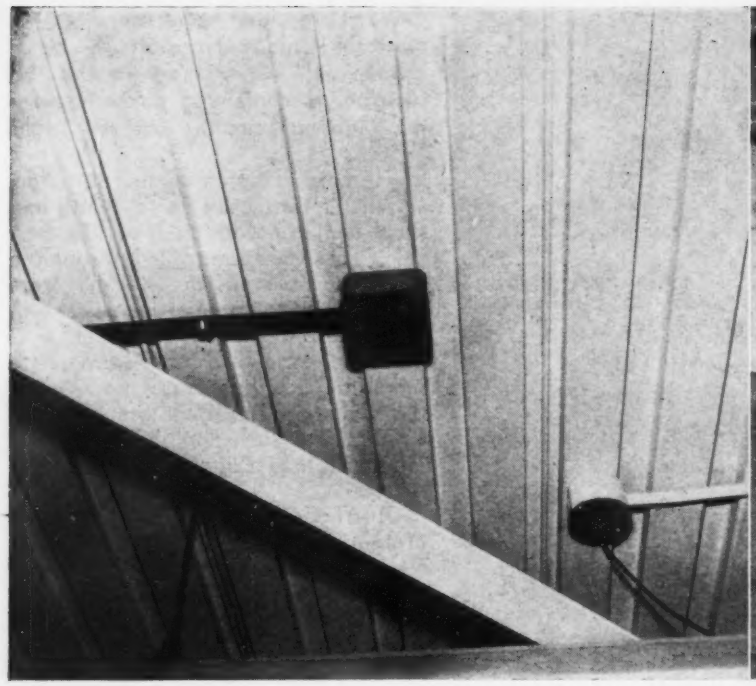
Floor lights on the exterior of the building to light the surrounding yard area were mounted at the roof. There are three floodlights on the east side, six on the north, six on the south and three banks of four each on the west side. These are controlled through a Sangamo time switch and fed from the power transformer bank instead of the lighting substations. Separate banks of three air-cooled transformers to serve the floodlights are mounted in the roof trusses near the center of distribution for such floodlighting. These are 480-volt to 120-volt, 20-kva. transformers.

Obstruction lights are likewise placed around the roof. These too are on separate circuits, fed directly from the lighting panel. Twin lights are placed on the corners and single lights on each side.

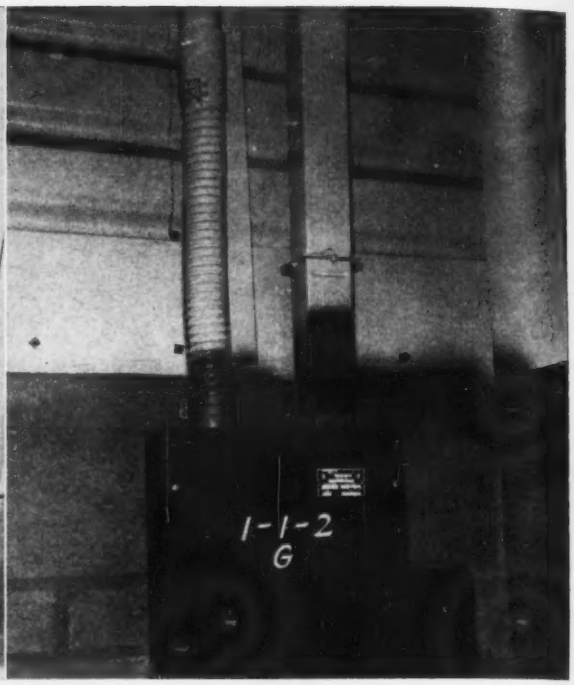
Power

Power is supplied to the entire building at 4,160-volts three phase. Where power enters building is a metalclad switchgear assembly consisting of one main panel and three outgoing feeders. Circuit breakers are of the air break type—100,000 kva. interrupting capacity. Switchgear is Westinghouse make. One feeder serves two unit substations on the south side of the building. One of these substations is rated at 300 kva. with a 480-volt three-phase secondary. The other is rated at 100 kva. with a three-phase secondary of 120/208-volt for lighting on the south mezzanine floor.

General view of entire area, shows lighting. One of the transformer platforms can be seen in the trusses about the center of the picture. Mezzanine offices are along the right side, each with balcony. Large doors at the end are operated from push button controls at each side which actuate 10-hp. motors located in roof trusses above them



Closeup of Q-floor steel ceiling of one of the mezzanines showing a power tap made through a pullbox attached to and connected with the floor cell at center. The lighting outlet box (right) however, is fed by conduit. The fluorescent lighting units were suspended from the steel floor

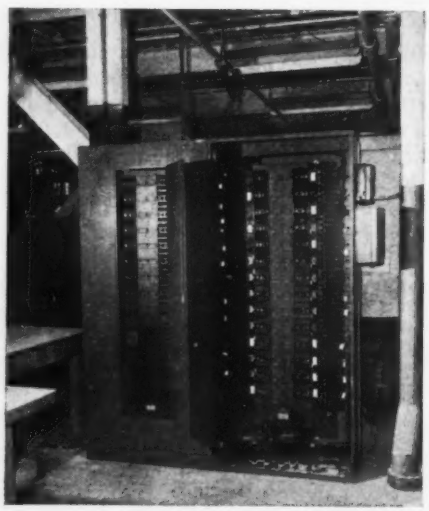


A lighting panel for part of the mezzanine rests on the floor itself, so flexible connections from it are necessary to the upper part of the building which is movable for contraction and expansion. Flexible conduit was used for connection to conduit; a telescoping duct at right

The second feeder serves two unit substations on the north side of the building. One of these is a 500-kva. three-phase 480-volt power substation and the other a 100 kva. three-phase 120/208-volt sub for lighting the mezzanine floor on the north side.

A third feeder serves these three unit substations for main lighting. All unit substations are air cooled. As previously stated, these are located at the lower cord of the trusses. Each substation has a capacity of 150 kva. The secondary from each of these supplies 120/208-volt to three lighting panels, which are controlled from the ground floor through contactors as previously mentioned. All 480-volt circuits are protected by circuit breakers of a combined thermal and magnetic type; 480-volt sub-panels are equipped with Westinghouse type AB circuit breakers. Unit substations are Allis-Chalmers.

Power for use in the main manufacturing area is distributed at 480 volts under the floor to a number of "utility pits." These consist of a concrete box below floor level, covered by a steel plate. Inside are locking type receptacles from which transformers on the floor are fed. Some of these transformers are on a portable dolly equipped with multibreakers and connector strip for plugging in portable tools, lamps, etc. In other areas, large jigs for the fabrication of parts of airplanes may have transformers built right on the jig. These too will be protected by multibreakers and connector strips will be provided for the plugging in of tools.



Power panel on main floor under mezzanine. Note telescoping duct at left for distribution to frame of the building, also the Q floor just above

Similar utility pits for power are located out in the field adjacent to the building, three on the north and two on the south side, to provide sources of power for work in the open.

The floors of the mezzanine are Robertson Q flooring which provide channels for wireways. However this channel is used only for power distribution and not for lighting. Over the machine and workshop areas, the 120-volt power is tapped from feeders in the Q floor to outlet boxes and leads are taken from these down to the machines through conduit to flexible couplings at the machines. In one case over a workshop area outlet boxes are equipped with receptacles and portable tools are fed from these receptacles through heavy-duty cords.

Because the transformers, switchboards and the machines in the machine shop are anchored to the concrete floor, a flexible means of serving them power or of distributing from the substations or panelboard was required. Either rigid conduit or metal duct was used for all wiring. Consequently where the connection was made between a rigid conduit, affixed to the structure, to a panelboard or part of the equipment anchored to the floor, a piece of flexible metallic tubing was used. Sufficient flexibility was found in such material to respond to the movement of the building from contraction or expansion. Where a metal duct was used for a power circuit, the duct was provided with a telescoping sleeve fitting which would permit free movement between the fixed and the moveable portion.

Because no drilling of the steel structure was permitted, the problem of affixing conduit and the duct as well as the hanging of the fixtures to the framework was complicated. Only the

Q floor was allowed to be drilled and the conduit supplying the fluorescent fixtures under each floor was affixed to the Q flooring by means of clamps bolted to the conduit.

To hold the conduit or duct to the structure itself, ingenious clamps had to be developed by the electrical contractor. The incandescent lighting units themselves were suspended from the wooden catwalk, which itself was clamped to the steel structure.

Engineering of this unusual job was in charge of Harvey R. Berry, chief electrical engineer, plant engineering department of Lockheed Aircraft Corp. He had charge of the entire electrical and illumination planning. A group supervisor of engineering was A. I. Greenwood, staff engineer, who handled most of the details for Harvey R. Berry.

Installation problems were handled by C. D. Draucker Electrical Company, electrical contractors for the job. Claude Reynolds was electrical superintendent for the contractor. M. L. Fowler, field engineer for Benjamin Electric Mfg. Co., acted in an advisory capacity on the lighting plan.

Because even larger aircraft are being developed by this progressive company for commercial airlines after the war, the facilities of this large factory provide necessary room for the assembly of such huge aircraft. Until the war is won, however, these facilities are turned to the making of huge transport planes for the armed services. Experience from such building will be put to good use for the civilian aircraft of the future.

Protests Electrical Equipment Ratings

BECAUSE the conditions of which he protested are the same as those of which electrical inspectors, contractors, wiremen and suppliers have also complained in the United States, the remarks of F. J. Bartholomew, electrical engineer of Vancouver, B.C., before the Western meeting of the Canadian Electrical Assn. recently, are particularly important. With the National Electrical Code under revision at the present time and Underwriters' Laboratories preparing to revise their standards, the need for a complete revamping of the ratings of electrical equipment for low-voltage systems and interior wiring is eloquently expressed in Bartholomew's paper.

Indeed, the presentation of it brought forth the passage of three resolutions making recommendations to the Canadian Engineering Standards Assn. (to which Underwriters' Laboratories is the corresponding U. S. organization). These were proposed by Bartholomew and seconded by E. V. Caton, Winnepeg Electric Co. The resolutions follow:

1. That the practice of approving low-tension wiring accessories for service for which they are unsafe or unsuitable and/or for current ratings which they are unable to meet over a reasonable life, should be discontinued.

2. That so-called safety, fused, knife switches be no longer approved for current ratings which they are unable to meet within the specified temperature rise when tested or used with fuses in place. That any approval given be based on tests carried out with approved fuses of the maximum current rating, inserted in the fuse clips and with full current flowing at 60 cycles, for a long enough period to insure that the switch and fuses are able to carry their rated current continuously without exceeding permitted rise in temperature.

3. That a study be undertaken and standards established for low-tension fuses of such different rupturing and current-carrying capacities as are needed to meet the service requirements of modern low-tension distribution systems.

In presenting the resolutions to the meeting, Bartholomew said he had listened with much interest to the discussion on adequate wiring, but he felt there was another phase to the subject which he had not heard discussed, nor had he seen any publicity regarding this matter in the trade and technical publications. Bartholomew said he referred to numerous fittings and attachments pertaining to domestic and commercial portable appliances of all kinds, as well as to receptacles and plugs for connections to extension cords. He particularly mentioned trilight lamp receptacles, electric iron cord attachments, and connections to hot plates and toasters.

Of all these types of equipment, he said, he considered the three-way plug extension should be mentioned as one of the most objectionable. He felt, however, that every engineer would admit that the whole range of this class of accessory which had been duly inspected and approved by the Standards association (U. L. in the U.S.A.) included an immense number of items that did not satisfy any real standard of utility, and which in many cases constituted real fire hazards. Continuing, Bartholomew said:

"I venture to suggest that there isn't a member in this audience who has not on innumerable occasions cursed the inability of some plug to make decent contact in the receptacle which should supply the current for the appliance or motor, or whatever it is at the end of the extension cord. I do not think it is too much to say that every year there are hundreds of thousands of these devices sold and in everyday service and which are quite incapable of carrying the current at which they have been rated and approved.

"Sound engineering and reasonable life have been sacrificed to shoddy cheapness and nastiness. I have yet to have experienced a tri-lite lamp fixture which in regular service will last more than a year or so. In my own house I try to keep a stock of fixtures to replace those which regularly wear out. The switch fails to make contact in one or other of its positions and it is a mystery to me how the flimsy parts, of which these fittings are usually built, can have ever been expected to have a reasonable life in regular service.

"I should also like to refer to the design and construction of the standard 10-amp. circuit switch. If such a switch is ever called on to control a load in excess of 5 or 6 amp., in most cases it is only a short time before contact trouble and overheating result. I can see no justification for the rating of any electrical equipment at values which every electrical engineer knows are overstated if a reasonable trouble-free life is to be expected.

"I also wish to bring before this meeting the ratings given to externally operated knife switches of the so-called safety type. Every electrical engineer who has had any continuing connection with, or responsibility for, extensive low-tension lighting and power installations has constantly found trouble occurring on such switches with overheating and consequent failure of contacts at current values far below the approved current-carrying capacity.

"This results from developments of practice common 20 and 25 years ago. At that time open switches and fuses were conventionally used on open type switchboards, and switches in that condition satisfactorily carried their rated currents. Fuses mounted on open panels would carry certainly very close to their continuously rated currents.

"When, however, practice changed

and safety requirements brought about the use of individual enclosures, which were required to house both switches and fuses, the ratings previously given to such switches and fuses for open mounting were quite unsuitable, and we in Canada, as well as the industry and inspection authorities in the United States, failed to recognize the obvious derating which should have been given to them in the new conditions of use.

"I have myself carried out a series of tests on safety switches made by three different manufacturers in ratings of 100 and 200 amp. and at 250 and 550 volts. It is apparent from these tests that safety, fused, knife switches are capable of carrying not more than 2/3 of their rated current without exceeding the temperature rise permitted by Canadian Engineering Standards Assn. rules.

"Unfortunately, our method of testing such switches is to determine the current-carrying capacity of the switch with copper bars in place of fuses and to test the fuses for current and fusing capacity only, in the open. I think you will agree that this is an unreasonable approach to the subject, when everybody knows that a fused knife switch is used with its fuses in place.

"I have already brought this matter to the Engineering Standards Assn. and sent them a complete report of my own investigations into the matter, and when I was recently in the East I found they had initiated similar tests themselves, but they had attacked the problem in a different manner. They had installed a number of units and had put full-load current through them right at the start, and I saw a number of switches that had literally dropped to pieces during these tests.

"My own approach was to start out with a low current and determine what current the fused switch could carry without exceeding the permitted temperature rise. Actually, my tests were carried out on new switches and only lasted a matter of weeks, and I rather presume that the current values which I determined as their carrying capacities would be considerably less had the tests been prolonged a matter of months.

"This situation leads to differences of opinion with inspection authorities; for example, the load which may have a continuous demand of 150 amp. cannot be safely protected by a 200-amp. switch and when a 400-amp. switch is installed, the inspection authorities will frequently ask for larger cables than are necessary for the load on account of the size of the switch being used.

"Power companies and other expert users of electrical energy enjoy proper protection in the rating of equipment which they purchase. Motors, generators and transformers are all purchased on the basis of their capacity with a stated temperature rise, and in fact the Standards association does insure that such equipment is able to do its work without exceeding such temperature rise, and the standards of construction required for a proper life.

"The same thing applies to heavy switchgear, circuit breakers, cables and so forth, and I can see no justification why small accessories and circuit switches, which are used in their thousands and ten of thousands, should be approved and placed on the market in the full knowledge that the ratings for which they are approved bear little relationship to their service capacities. This practice represents a shirking of responsibility and obligations by electrical engineers and manufacturers towards the less well informed, less skilled users of electrical energy.

"I know it will be stated that there are available today a number of makes of small automatic circuit breakers which can replace the present highly unsatisfactory so-called safety switch, in which the definition 'safety' is a misnomer, but I think there will always be a need for fused knife switch protection and the problem should be frankly faced and solved.

"These so-called safety switches are not safe and probably have resulted in many fires, the causes of which have officially been described as 'unknown' or 'probably of electrical origin.' I quite appreciate that it would not be wise to endeavor to change established practice when industry is under the heavy strain of war production. I consider, however, that this whole question should be tackled boldly after war pressure has ceased, and that Canadian engineering and industry should not be satisfied to produce and market equipment which is falsely described. (The same can be said for that of the U.S. —Editor.)

"I wish also to raise the question of the interrupting capacity of fuses. In recent years low-tension distribution systems have grown in individual magnitude and the failure of these fuses to interrupt short-circuit currents occurring has been the cause of many unnecessarily prolonged power service failures. Fuses are today rated by their current-carrying capacity without any regard to interrupting capacity. Where fused low-tension distribution centers are located near a large bank of transformers, short-circuit currents are much in excess of the interrupting capacity of most fuses used today. There is an urgent need for two, and possibly three, styles of fuses based upon current-interrupting capacity. I am not prepared to state definitely what these should be, but I should think a rupturing capacity of 1,000 or 2,000 amp. for 30-amp. fuses might be entirely satisfactory for most lighting circuits. For 100- and 200-amp. fuses, the minimum rupturing capacity might be 5,000 or 10,000. The superior type of fuses should probably be able to interrupt 20,000 amp., and it may be that there is a need for fuses having 30,000- to 50,000-amp. rupturing capacity.

"A wide study of the subject is necessary to determine the actual requirements. This principle of rating fuses on their current rupturing capacity has been universally adopted in Europe, and a study of the ratings and conditions there would undoubtedly be a helpful guide in determining proper ratings for use in Canada (or the U.S.)

"I can see no technical or manufacturing difficulty in developing fuses to meet actual circuit requirements in Canada, nor any necessity for us to lag behind manufacturing and engineering standards of other countries."

Seattle Mercury

Experiments with mercury vapor for street lighting have begun in Seattle as one block, on Fourth Avenue South, one of the heaviest traffic arteries in the city, has been lighted from eight standards at staggered intervals. Lamps used are the G-E 400-watt, 16,000-lumen lamps in fixtures equipped with both reflectors and refracting glassware to concentrate illumination on the street. The installation was made after studies of Denver, Portland, San Francisco and Los Angeles installations by Charles R. Wartell, city engineer, E. R. Hoffman, City Light Department superintendent, and J. W. A. Bollong, traffic engineer, and J. R. Peters, engineer of outside construction for City Light. If the experiment proves satisfactory, mercury lighting may figure prominently in a proposed $1,500,000 postwar street relighting program.

Salt Lake Incandescent

Sixty-three new 6,000-lumen incandescent lamps will replace 14 old type standards on State Street and Ninth South in Salt Lake City, as a means of reducing traffic fatalities on these heavily traveled streets. The city commission approved plans submitted by Utah Power & Light Co. after testimony by the chief of the traffic police and a traffic sergeant, giving detailed reports on accidents over the past three years. After lighting of Second West Street, once called "the avenue of death," fatal accidents on that street were reduced 76% and all accidents 59%, it was testified.

Induction Electric Heating Theory

A compilation of information taken from published and other sources of material from the personal notes of the author and presented in condensed form for those seeking knowledge on fundamentals of high-frequency heating

Kenneth A. Smith

Electronic Chemical Engineering Co., Los Angeles

ALTHOUGH much has been written about induction electric heating, it has risen to such prominence that it appears desirable to attempt to discuss it in its simplest terms. One fact should be stressed, namely that the laws governing high-frequency induction heating are simple and known. Ohms law, transformer ratios, established laws of heat flow are standard and no mystery is introduced, as many persons would seem to believe, in considering high-frequency induction heating problems.

Induction Heating Theory

If an electrical conductor is placed in a varying magnetic field, a voltage will be induced in the conductor. According to Faraday's law of induction, the voltage around a circuit through which magnetic lines of force vary is equal to the time rate-of-change of the flux. The voltage induced in the work is proportional to the frequency of variation and to the total flux linking the work. The direction of flow of the induced secondary currents is such that the secondary magnetic field set up by the currents opposes the primary magnetic field.

If the conductor in the alternating magnetic field is in the form of a mass and does not constitute a complete circuit in the usual sense, then the induced secondary currents flow in closed loops within the mass and are called eddy currents. Eddy currents circulating within the material generate heat, and the power used is equal to the square of the current times the resistance through which it flows, (I^2R).

For magnetic materials, hysteresis losses are also present, and add to the heat generated. The molecules which compose a magnetic material may be considered as elemental magnets in themselves. As the polarity of the magnetic field surrounding the magnetic mass reverses, the molecules swing around to align themselves in the magnetic field. This movement causes heat to be generated by some sort of intermolecular friction.

At low frequencies the magnitude of the hysteresis heating effect is comparable with the eddy current losses. However, the hysteresis losses decrease with increasing temperature in the case of magnetic materials. At elevated temperatures of the heated material and at the frequencies used by high-frequency induction equipment, the hysteresis losses are usually small compared with eddy current losses.

Induction heating may be defined as the heating of a nominally electrical conducting material caused by its own I^2R losses, when the material is placed in a varying electromagnetic field. In practice, the material to be heated is placed in the field of a coil through which alternating current is flowing. Any charge or mass of material to be heated inductively can be thought of as a short-circuited secondary winding of a transformer, the primary being the heater coil.

The magnitude of the eddy currents depends upon the particular physical configuration. For example, if the heating coil consists of ten turns and is carrying 100 amp. of high-frequency current, it represents a 1,000 ampere-turn primary. If the magnetic coupling between the heater coil and the piece being heated were perfect, the current in a one-turn secondary would be 1,000 amp.

Because of the need for mechanical clearance and electrical insulation, however, the coupling is not unity but may actually be of the order of 0.5. The current in the one-turn secondary therefore will be 500 amp. For primary currents, coupling factors and secondary resistances in the range commonly encountered in induction heating, the power available for generating heat in the work can be increased only by increasing the resistance of the current path.

For direct currents, the current density is uniform throughout the cross-section of a conductor. For alternating currents, the current density, and consequently the heat generated, is not uniform throughout the work but is confined to the surface of the parts by the skin-effect phenomenon, the action by which current tends to flow more in the outer portions than at the center of a wire.

The skin-effect arises from the fact that elements parallel to the surface of a conductor, but at different points in the cross-section, do not have equal inductance. The central or axial element has the greatest inductance and the inductance of other elements decreases as the distance of the element from the axis conductor increases, becoming a minimum at the surface of the conductor.

The higher the frequency of the alternating current, the more it tends to hug the surface of the conductor. The load, therefore, in the induction furnace can be assumed to be only the surface portion of whatever charge is in the primary coil; and the resistance of that load will be greater as the frequency is increased and the effective current path is reduced in section. There is substantially only one reason for high frequency: *By using a high frequency, the resistance loss in the charge can be increased to the point where the charge cannot carry the induced current without becoming heated.*

Coupling between primary and secondary or load is important. As in any good transformer, coupling should be as close as possible; that is, the primary current path should be as near to the secondary or load current path as possible. Cylindrical coils and charges are easy to make—they fit together nicely; but there is no electrical reason why the primary windings and load cannot be (and they are) of square, triangular or of any other section so long as they are maintained in close inductive relation.

Depth of Penetration

Since there is no definite heating boundary, for simplicity in computations, the distance from the surface at which the current is 37% ($=\frac{100}{2.718}\%$) of its magnitude at the surface is defined as the *depth of penetration* of the current. At this point the power losses, which are proportional to the square of the current, have decreased

to about one-tenth of their surface value. As a first approximation, therefore, the depth of penetration may be taken as the depth of the layer in which the heat is generated.

The depth of penetration is given by the formula:

$$D=1400\sqrt{\frac{\rho}{\mu f}}$$

where D=depth of penetration (in.)
ρ=resistivity in Ohm/cm.^{3}
μ=magnetic permeability (for non-magnetic materials, =1)
f=frequency (cycles per second).

For example, with brass at room temperature where $\mu=1$;
$\rho=7.5\times10^{-6}$ ohm/cm.^{3}; f=500,000;
D=0.0055 in.

This depth of penetration is approximate only, depending upon the assumption of the net current remaining at this inner layer (in this case 37%) and on the curve that expresses the current density throughout this shell. In any case, the heat is generated in a very small volume at the surface of the conductor and varies only as the resistivity and permeability of the material changes with increasing temperature. The core of the work is heated mainly by thermal conduction from the surface layer.

For a given frequency, primary current, and coupling factor, the heat generated will depend upon the resistivity of the material. For example, if within the usual range of load resistances, the resistivity is increased four times, the depth of penetration will be doubled, thus increasing the cross-section of the conducting path by approximately two.

Speed of Heating vs. Frequency

There is no definite relation between frequency and speed of heating unless the element of power is also taken into consideration. With sufficient power, the speed of heating can be made the same over wide variations in frequency. In forging operations, the real criterion of speed of heating by electric induction is the rate at which heat flows by thermal conduction from the surface portion to the center of a charge piece. If the charge is large, a lower frequency will allow the heat to be generated in the piece further from the surface. If the charge is small, a higher frequency should be used to insure that the energy is absorbed before it reaches the center of the charge.

In heating a 3-in. diameter bar from cold to the forging temperature, for example, the average effective depth of current penetration for 1,000-cycle current is about 0.3 in. The penetration for 3,000-cycle current is about 0.2 in. Most of the energy is changed

Testing meters with a G-E photoelectric tester in PG and E meter shop

to heat near the surface with either frequency, but with the lower frequency the heating band is slightly deeper than for the higher frequency.

The heating time in either case must be sufficiently long to allow the heat to be conducted to the core so that, considering the lapse of time between the time the power is turned off and the piece is forged, the center and surface portions of the bar will be at substantially the same temperature. No matter which frequency is used, the time required to bring the piece to a uniform forging temperature will be about the same.

The actual heating time can vary, depending on how the piece as a whole is brought up to temperature. The power may be very large at the start, bringing the surface to the maximum temperature quickly; then the power may be dropped sharply to the point where the outside temperature will not overshoot while the center portion comes to temperature. This method heats the piece in the shortest possible time but is usually wasteful of equipment and hard to control. The method preferred by the writer is to use a comparatively simple power time cycle in which power averages a constant figure over the duration of the run and the center and outside portions of the bar come up together. Less power and far less control equipment is required.

In an actual installation which the writer believes is well designed, 100 kw. is used to heat a 19-in. length of a 3-in. diameter steel bar to 2,200° F. for forging a 105-millimeter shell. The heating cycle is four minutes, the frequency 1,000 cycles. At the end of four minutes, the bar is of uniform temperature. Of course, five or six bars are being heated simultaneously so that the production rate is but a fifth or sixth of the unit heating time.

A 2⅛-in. diameter bar is heated for two minutes and 20 seconds for forging a 75-millimeter shell. For a 1-in. diameter piece, one minute; and for a 7-in. square billet, 15 minutes, respectively, have been found sufficiently long to obtain uniformity of center and surface temperatures.

Where thin surface hardening is required, ultra high frequency with high power may save equipment cost. In some instances, only a very thin surface layer need be hardened and if frequency and power are sufficiently high to limit heating to that area, a real saving can be effected. A frequency of 500 kilocycles generated from a tube converter may have real merit.

For the deeper hardening now being practiced, where the charge diameters are over 2 in., for instance, any frequency above 1,000 cycles can be effective. For smaller diameters frequencies of 2,000, 3,000 and 10,000 cycles and up are necessary to be certain that the heating will be effectively limited to the surface areas. *With a given amount of power, the heating can be more effectively limited to the surface by using higher frequencies.*

Optimum Frequency

For a given size of work where uniform heating at a maximum rate is desired, as in melting or annealing, there is an optimum frequency beyond which the gains from increasing the frequency become less and less worthwhile. Assuming a constant total magnetic flux through the work, an increase in frequency would produce more voltage and hence more heating current. However, as the frequency is increased, the depth of penetration of the heat-producing eddy currents decreases, and this tends to counteract the increased heat generation usually gained by increasing the frequency. It has been shown mathematically that to develop the maximum rate of heating for a given frequency, the radius, a (inches), of a long wire or rod must be related to the frequency by the expression:

$$f=1.225\frac{\rho}{\mu a^2}\times10^7$$

When the foregoing condition is satisfied the expression for the rate of heating long wires and cylinders, for unit time, becomes

$$W=0.19H^2\mu f\times10^{-7}\ \text{watts/cm.}^3$$

where H = RMS magnetizing force at the surface of the wire or rod. Similar expressions, except for the value of the numerical constants, hold for flat strip.

The optimum frequencies for various diameters of iron wire that are heated above the Curie temperature

are given in the table below. The Curie temperature is that temperature above which ferromagnetism is no longer detectable, and the magnetic permeability is therefore equal to unity. It is around 1,400°F. for low-carbon steel.

Diameter (Inches)	Optimum Frequency (cycles per sec.)
1/4	118,000
1/8	472,000
1/16	1,888,000
1/32	7,555,000

Rate of Heating

The rate of heating strip is independent of its width. If any fractional width strip is substituted for full width sheet of the same thickness, the rate of heating when passed through the same inductor coil will be the same in both cases, assuming the heater coil maintains the same magnetizing force at the strip surface.

For magnetic materials heated below their Curie temperature, an approximate relationship can be given based on the condition that the magnetizing force is made considerably in excess of that corresponding to saturation flux density at the surface of the work. For wires and flat sheets, it is assumed that the thickness of the skin layer in which most of the magnetic flux will be found is small compared to the radius of the wire or does not exceed half the thickness of the strip. It is often possible to fulfill these conditions and the power lost in the material per square inch of surface is:

$$W=12.9\times10^{-4}\sqrt{\rho f N^3 B}$$

where W=watts/in.^{2} of work surface
N=RMS ampere-turns per cm. length of inductor coil
B=saturation flux density

Equations are helpful in understanding how frequency, thickness of the work, permeability and resistivity are related to the rate of heating but are of doubtful value quantitatively, because they are applicable only when the optimum frequency is used, and because it is difficult to assign an appropriate value for magnetic materials below the Curie temperature, which varies with the magnetizing force throughout the cross section of the work.

In magnetic materials below the Curie temperature, the depth of the heated layer is very small, due to the effects of the high permeability. However, the depth increases rather abruptly at a temperature above that at which the material becomes non-magnetic. Simultaneously the power being absorbed in the original layer is reduced. Therefore, steel with a high permeability and high specific resistance is readily heated in a thin surface layer while below the critical temperature.

Above this temperature the power absorbed is less, the rate of heating decreases, and the depth of penetration is considerably greater. As the hardening temperature of steel is somewhat above the Curie temperature, the possibility of overheating is greatly reduced and the need for critical control of the heating operation is minimized.

Thermal Conduction

Heat conductivity is the quantity of heat in gram-calories that is transmitted through a plate 1 cm. thick across an area of 1 sq. cm. when the temperature difference is 1°C. For average steels, the heat conductivity is 0.2 gram-calorie per sq. cm. per cm./sec./degree C. Since one gram-calorie per sq. cm. per second equals 4,185 watt-seconds per sq. cm. for a temperature gradient of 1°C. per cm., the power input per sq. cm. required to produce a temperature gradient of 1°C. per cm. is $4.185\times0.2=0.84$ watts per sq. cm. In the surface hardening of steel, the power that is actually delivered into the work is the temperature gradients per sq. cm. in the surface to be treated.

The thickness of the hardened layer, because of the thermal conductivity of the steel, is not solely determined by the depth of penetration but also by the power input to the heating coil and the heating time. Practically, the part to be surface hardened is heated inductively and quenched when the desired penetration has been achieved. Even with very high frequencies, thick hardened layers can be obtained. Less power input with a longer heating time results in thicker layers than a high power input and a shorter time cycle.

For very thin case depths or where exceptionally rapid hardening is required, the power input per sq. cm. can advantageously be increased to one and one-half times or twice that given above. Any reference to dimensions and power required to achieve a specified degree of heat penetration must be considered approximate because there are a number of variables in any given problem.

In the above calculation of the power required for surface hardening, the heat lost from the surface to the air and by radiation to surrounding objects was not considered. However, this loss is negligible as compared to the losses by thermal conduction to the interior of the mass. For a surface that is at a temperature of 1,300°F., the rate of energy loss to the internal layer is about 4,000 watts per sq. in., while only 25 watts per sq. in. are being lost to the outside air.

Frequencies Used

The frequencies used for induction heating can be very roughly divided into three groups. The first group includes frequencies up to one thousand cycles per second and is limited almost entirely to forging and melting steel and non-ferrous metals either directly or by heating electrically conductive crucibles. The power used varies from a few watts to thousands of kilowatts, generated by motor-generator sets.

The second group covers frequencies from one thousand to ten thousand cycles per second. The power is generated almost entirely by rotating machines with power ratings up to 1,200 kw. The applications in this group include most of the simple heating processes such as forging, brazing, soldering and melting. These frequencies have been used for surface hardening relatively large parts where contours need not be too closely followed, and where the depth of case need not be too small.

Large steel parts can be satisfactorily heated at intermediate frequencies. Much higher frequencies are required for irregular parts where the contour must be followed closely, where coupling is difficult because of the shape or small size, and where extreme localization of the heat is a necessity. To heat low resistance metals such as silver, copper, aluminum and brass, readily, the magnetic flux densities required are difficult to obtain at the intermediate frequencies. The higher frequencies permit the use of more normal flux densities and the higher losses produce the required heating.

The third group of frequencies ranges from 50 kilocycles to several megacycles. The generation of power at these frequencies is almost entirely limited to spark-gap and vacuum-tube oscillators. The spark-gap type of equipment has been built for frequencies from 50 kc. to 200 kc. and for power outputs up to 25 kw. However, its efficiency decreases quite rapidly at the higher frequencies. Vacuum tube equipment has no theoretical frequency or power limitations. In the dielectric heating field the vacuum tube oscillator is the only source capable of producing sufficient power at the frequencies necessary. Present equipment uses frequencies from 1 mc. to 50 mc. and powers ranging up to hundreds of kilowatts.

In a subsequent article the subject of dielectric heating will be treated in a manner similar to this presentation of the fundamentals of induction high-frequency heating.

220-Kv. Carrier-Current Relaying

PG and E Installs High-Speed Carrier-Current Type Relays on Important Link in Its Extensive 200-Kv. Transmission System

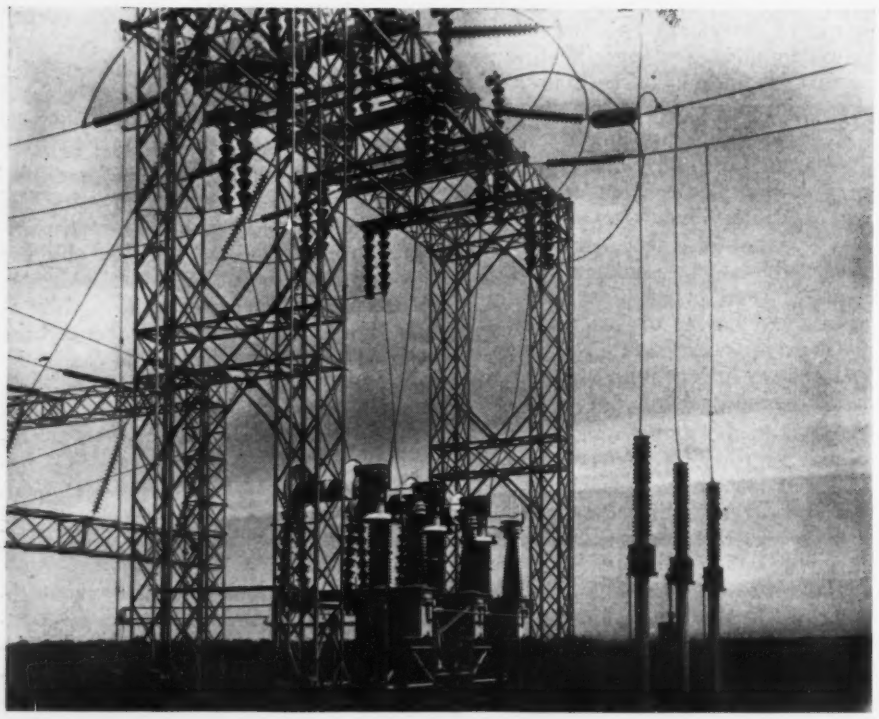
J. L. Buckley
Assistant Engineer
Pacific Gas and Electric Co.

IN the Pacific Gas and Electric Co.'s transmission system feeding Shasta and Pit River power into the San Francisco Bay region, one of the important links is a 41.5-mile section of 220-kv. line between Contra Costa and Newark substations. Shasta power house of the Central Valley Project of the U. S. Bureau of Reclamation normally delivers power to Newark over a 220-kv. circuit completed in 1944 from Vaca-Dixon to Newark substation. At Contra Costa substation this circuit feeds into the 110-kv. bus through a 90,000-kva. transformer bank. This bus is also connected to the Avon and Martinez steam plants, each of which is rated at approximately 50,000 kva., and to the 110-kv. bus at Newark substation as well. Under some conditions the company's Pit River power will also be transmitted over the 220-kv. Vaca-Dixon-Newark line.

Engineering studies revealed that faults of longer than six cycles duration on the important Contra Costa-Newark 220-kv. tie were likely to produce instability. For that reason the engineering and operating departments decided to install carrier-current relaying on this 220-kv. circuit. Also, all tripping on the 110-kv. and 220-kv. systems is being speeded up so it seemed advisable to gain some operating experience with relays of the high-speed carrier-current type.

The complete equipment as installed at each substation consists of three directional impedance step type relays, one directional overcurrent carrier ground relay, one directional overcurrent ground relay with instantaneous trip attachment for carrier ground relay back-up, one carrier auxiliary relay, three 230-kv. coupling capacitors, three capacitor potential devices, one wave trap with a tuning range of 50 to 150 kilocycles.

220-kv. switch structure showing three coupling capacitors for carrier relaying. The two on the outside conductors are for supplying potential only, while the one in the center, with its associated line trap, is also used for carrier relaying. Cabinet for transmitter-receiver is mounted on center post



The electrical arrangement of this equipment is shown in Fig. 1.

To better understand the operation of the carrier controlled relays, the following review of the operation of the impedance relays is given. This relay is a three-element directional high-speed, three-zone, distance type relay which operates instantaneously in zone 1, and with an adjustable time delay in zones 2 and 3. The relay is used for directional-phase fault protection on transmission systems and is designed to be used either independently or in a high-speed carrier-current relaying system. The cost installed is quite high and limits the use to the more important high-tension lines.

This relay is connected to receive a current and voltage proportional to those existing on the protected high-tension line. With a fault in zone 1 (Fig. 2), a given amount of current I will flow from the relay location to the fault. With zero voltage at the fault, the voltage at the relay must be equal to the drop in the line due to the current I, or equal to IZ where Z is the impedance to neutral of the line from the relay to the point of fault. The ratio of voltage to current at the relay is IZ/I=Z. Thus the ratio is constant for any value of current as the voltage on the relay is proportional to the current times the line impedance. Therefore, if the current coil of the first impedance element of the relay is adjusted for a value of current such that the pull of the current coil is just equal to the potential restraint for a fault at the end of zone 1 (Fig. 2), the beam of the element will be balanced at that point for any value of current. If the fault occurs to the right of this balance point, the beam will not trip as the voltage pull is the greater due to a larger amount of impedance and therefore a higher voltage and a correspondingly larger potential restraint than the beam is balanced for. The second impedance element is adjusted to balance for a fault at the end of zone 2 and therefore operates after a time delay for faults anywhere up to this point. Likewise, the third impedance element is adjusted to balance for a fault at the end of zone 3 and operates after a

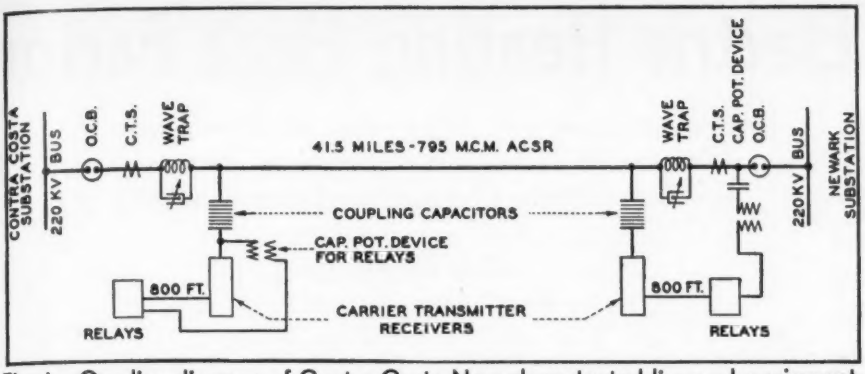


Fig. 1—One line diagram of Contra Costa-Newark protected line and equipment

greater time delay for faults in all three zones.

When used with carrier-current blocking, the zones are assigned just as they were when used without the carrier. For a phase-to-phase fault in the shaded portion of zone 1 adjacent to breaker 1, see Fig. 2. Breaker 1 is tripped by the contacts of the first impedance element of its associated relay. Breaker 2 is tripped by the contacts of the second impedance element of its associated relay either instantaneously through carrier contacts or after a time delay independent of carrier.

For a phase-to-phase fault in the unshaded portion of zone 1, see Fig. 2. Breakers 1 and 2 are tripped directly by the contacts of the first impedance elements of their associated relays.

For a phase-to-phase fault in the shaded portion of zone 2 adjacent to breaker 2, see Fig. 2. Breaker 1 is tripped by the contacts of the second impedance element of its associated relay either instantaneously through carrier contacts or after a time delay independent of carrier. Breaker 2 is tripped by the contacts of the first impedance element of its associated relay.

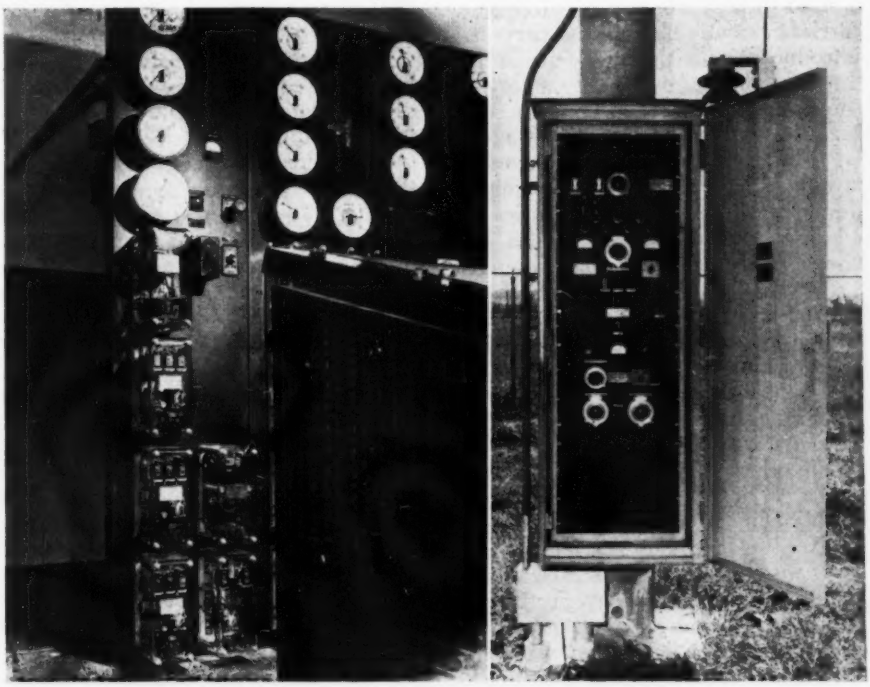
For phase-to-phase faults in zone 2 beyond breaker 2, see Fig. 2. Instantaneous tripping of breaker 1 is blocked by carrier action. Tripping of breaker 2 is prevented by directional contacts being open. Breaker 1 is tripped if necessary by the contacts of the second impedance element of its associated relay as back-up protection for breaker 3.

For phase-to-phase faults in zone 3, see Fig. 2. Breaker 1 is tripped if necessary after a time delay by the contacts of the third impedance element of its associated relay as back-up protection for breaker 3.

For all ground faults, the carrier ground relay is given preference over the phase relays in the control of the carrier. Instantaneous tripping between breakers 1 and 2 is then accomplished by the carrier ground relay or the contacts of the first element of the impedance relays. The directional overcurrent ground relay is used as a back-up for the carrier ground relay.

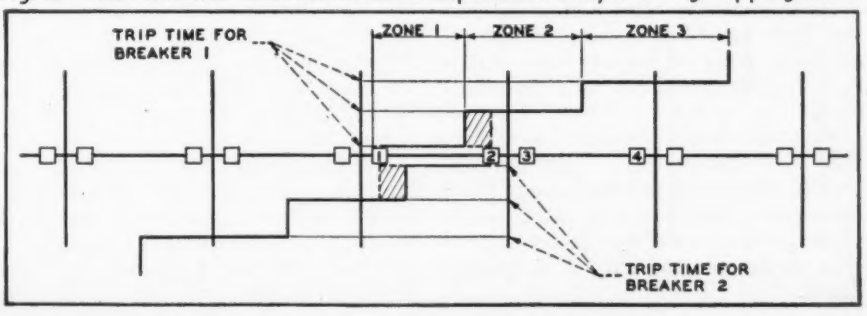
Summarizing: the addition of carrier control permits instantaneous tripping of both breakers simultaneously for phase-to-phase and phase-to-ground faults on the section of 220-kv. line between Contra Costa and Newark substations, but blocks instantaneous tripping of the breakers on the Contra Costa-Newark line for all faults outside of that section.

As an illustration of the carrier operation, assume an internal phase-to-phase fault just beyond the zone of one of the first impedance elements. See Fig. 2. Carrier will be initiated immediately at both ends of the protected line section by the closure of one of the contacts of the third impedance element. Meanwhile, the directional and second zone impedance contacts close and energize an auxiliary switch of the carrier auxiliary relay which stops the carrier and energizes an operating coil of this same blocking relay. Since the same action has occurred at the far end



Carrier relaying panel (left) at Contra Costa. Relay at upper left is a directional overcurrent ground relay, while the three cases immediately below contain directional impedance relays. Lower right relay is directional overcurrent carrier ground relay and the one above is a carrier auxiliary relay. Photograph at right shows the transmitter-receiver cabinet and panel mounted on post which supports the 220-kv. coupling capacitor. From top to bottom on the panel are line tuning, transmitter, modulator, and receiver units

Fig. 2—Time-distance characteristics of impedance relay showing tripping zones



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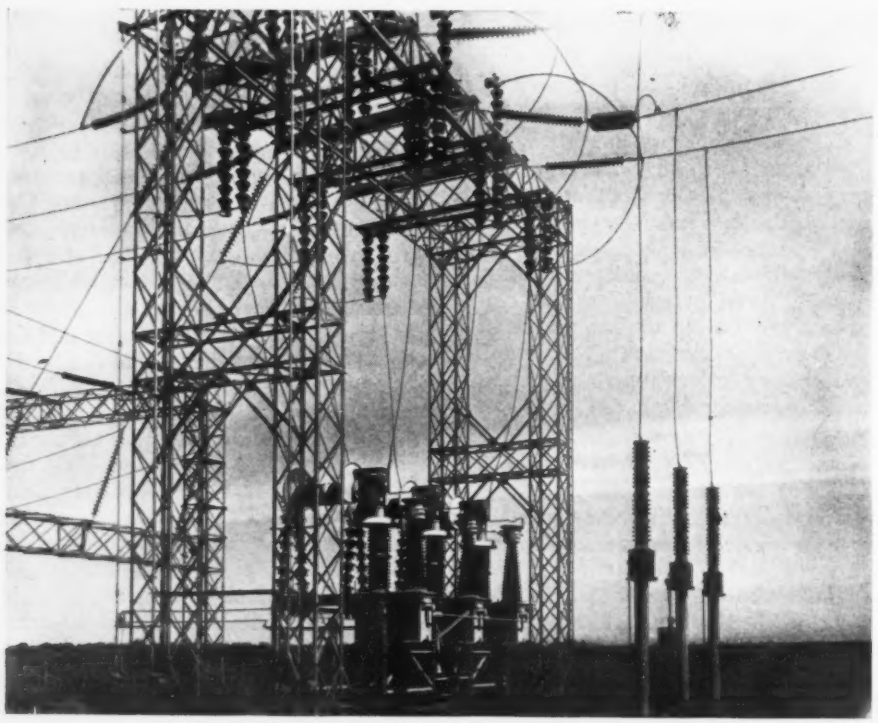

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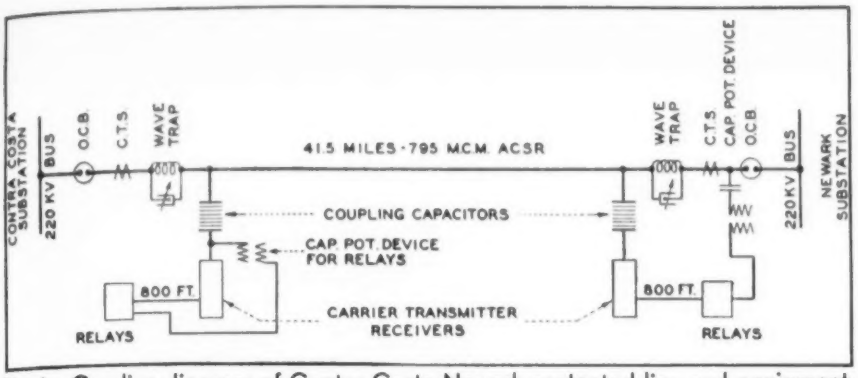

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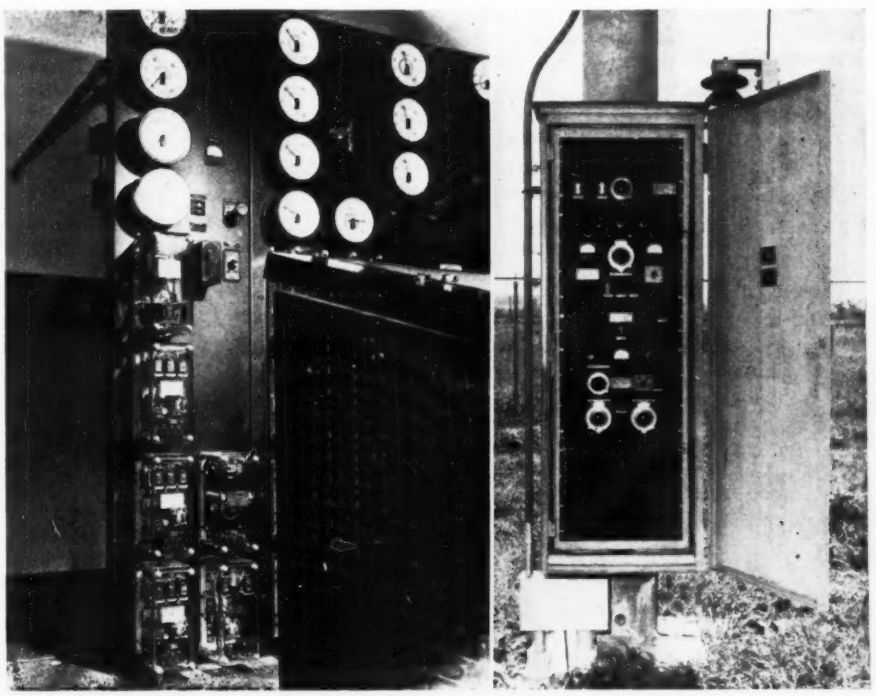

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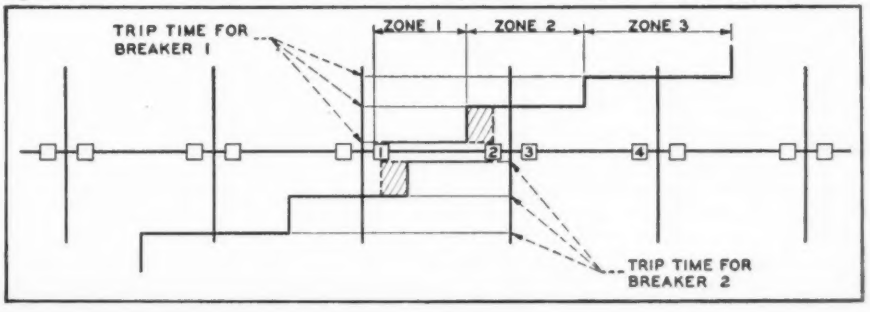


of the line, no carrier is received and a blocking contact is closed at both ends completing the trip circuits through the directional and the second impedance element contacts. If the fault had been external to the line section, tripping could not have occurred as the carrier holding coil would have been energized by the carrier from the far end thus maintaining carrier blocking.

As an additional feature, point-to-point communication using a monophone handset is installed. This is a good single-frequency communication channel and will be useful for the operation of these substations. Using the carrier as a communication channel does not interfere with the action of the relays as they take over the operation of the carrier for the duration of the fault.

A standard Colpitts oscillator circuit is used to generate the high-frequency carrier-current. This carrier-current is introduced onto the high-tension line through the coupling capacitors as shown on Fig. 1. When used for relaying, the carrier-current is not modulated but actuates the receiver and relays directly. The word carrier implies that the high-frequency carries an additional signal and is thus a misnomer when used only for relaying.

A wave trap is installed in the line on the circuit breaker side of each capacitor tap. This consists essentially of an air core reactor with an adjustable capacitor connected in parallel to form a parallel resonant circuit. These traps reduce the attenuation or transmission loss, prevent short circuiting of the carrier due to external faults or intentionally applied grounds and effectively isolate the carrier channel. Tests were made after the traps were installed to determine their effectiveness. It was found that opening and closing a ground switch beyond a wave trap varied the carrier signal a negligible amount, even though one side of the oscillator circuit was connected to ground.

The attenuation or loss in carrier-current energy has not yet been measured. This is a relatively short transmission line and the power output of the transmitter (15 watts) is several times greater than necessary to operate the receiver relays.

As this carrier relay equipment has just been placed in service, it will be sometime before adequate data on the maintenance problems will be available.

Only the fundamentals of a carrier relay installation have been covered herein. Many other installations have been made and there is rather complete literature on the subject for those who would like to study it in greater detail.

Electric Heating Heat Factor

Kilowatt-hours per degree-day of climate per 1,000 cu. ft. of house is proposed as "heat factor" for use in electric house heating comparisons

H. C. Bender

Dealer Sales Developement Engineer Washington Water Power Co., Spokane

VOLUMES of statistics, covering practically every phase of the subject, have been published on electric house heating. Each investigator, however, has his own methods of collecting data, and his own ideas of what he wishes the statistics to show. Much confusion as yet exists in the statistics quoted, as the fundamental characteristics of the electric heating load have not been fully explored.

One of the first problems that we have worked on has been the relation of consumption in kilowatt-hours to types of application. We have found quite different consumptions of electric energy where it would seem they should be alike. In other words, the statistics quoted seemed to be inconsistent. Some of the published data on electric heating was not complete and, thus, was not usable in our study.

This study has to do only with our search of published data on electrical heating, made in an endeavor to find some common denominator that could be applied to consumption data collected under all types of climates and other conditions. Therefore, if our premises are correct, we shall be able to apply this common denominator to data collected in Longview, Wash., or Quebec, Canada, and still have it satisfy conditions in Spokane or any other section of the country and, in the end, be reasonably sure that our results would be consistent and reliable.

The nearest approach to this common denominator, so far developed, is what we choose to call a "heat factor." This heat factor, as we have developed it, is the number of kilowatt-hours consumed per degree-day of climate per 1,000 cu. ft. of house. The degree-days, based at 65°, are always available at each local United States Weather Bureau office. In all the early figures issued by the United States Weather Bureau, the basic figure was 70°, so wherever these figures are found, it becomes necessary to reduce them to the 65° base.

For the benefit of those who may not know how the degree-day is arrived at, the following is a quotation direct from the U. S. Department of Commerce Weather Bureau, psychromatic data sheet, W. B. 103: "To obtain the total degree-days, substract the mean temperature for each day from 65°, and add together the differences. Omit days with a mean temperature of 65° or above, as heating engineers consider such days as requiring no additional heating".

The last portion of the formula has led to considerable confusion. Just what is the cubic content of a house? One method of determining the cubic content is to measure each room, totaling the figures for each room in the house, and labeling the resulting sum the net volume. Closets and halls are often left out.

We have chosen to consider the overall, or outside, dimensions. The gross area is simple. Determination of the height, however, is a questionable factor, and must be agreed upon. Wherever possible, we have measured the distance from the under side of the floor joist to the top side of the ceiling joist, using this as the height of the house in determining the cubic content. We found that if the basement were included, the heat factor became eratic, so it has been disregarded in all cases and is considered in the type grouping.

In working with this heat factor, it soon became apparent that similar types of houses had similar heat factors. For example: Houses without basements, with insulated walls and weather stripped windows had one factor; houses without insulated walls had another; houses where the heat was generated within the room had the lowest factor; and houses where the heat was generated at a central point in the basement had the highest factor.

Some of the data collected has been listed in Table I. If it proves valuable, we must agree on methods of collecting further data, so as to make all our figures consistent.

An analysis of the heat factors shown, brings out some interesting facts. We have factors ranging from 0.8 to 0.2. In other words, the maximum use per cubic foot of house is four times the minimum use per cubic foot of house. Obviously, we cannot sell a satisfactory heating service where this use per unit house varies to such an extent.

Table I

Location	Number Units	Cubic Contents (House Average)	Insulation[1 2 3]	Year of Record	Season (Deg. Days)	Installed Capacity (Kw.)	Installed Capacity (Watts per cu.ft.)	Consumption (Kwh., Season)	Heat Factor (Kwh./per deg.-day per 1,000 cu. ft.	
Spokane, Wash.	2	12,300	None	1916-7-8	6,303[5]	24.0	2.0	61,500	0.811	Furnace conversion. Sw. control. Opened windows to cool off. Poor construction.
LaGrange, Ill.	1	14,210	W-C-D	1928-9	6,420[6]	40.0	2.8	34,050	0.317	Water heat storage off-peak. Thermo-control.
Fort Wayne, Ind.	18	21,200	...	1928-9	6,420[6]	47.8	2.3	48,800	0.359	Net area used.
Quebec, Canada	27	22,300	W-C-D	1931-2	9,935	24.6	1.1[7]	67,800	0.310	Net area used.
Medford, Ore.	3	4,627	W-C	1943-4	4,654	10.5	2.27	6,256	0.291	Direct heat. Thermo-control. No basements.
TVA Pickwick Landing	13	9,600	W-C	1935-6	3,831	26.7	2.74	9,760	0.264	insulated walls and ceilings with weather
Portland G. E. Co.	20	7,971	W-C-D	1943	4,244	15.9	2.00	8,809	0.262	stripping on doors and windows.
Longview, Wash.	19	7,920	W-C-D	1942	5,620	16.5	2.08	11,800	0.264	
Longview, Wash.	39	8,204	W-C-D	1943	5,150	15.5	1.90	10,703	0.254	
Spokane (part year only)	1	6,300	W-C-D	1944[4]	3,100[4]	3.0	1.00	5,337[4]	0.273	Double doors and windows.
TVA Knoxville, Tenn.	6	...	W-C	1942-3	3,600	...	...	...	0.319	Direct heat. No basement.
Chattanooga, Tenn.	10	...	None	1942-3	3,500	...	...	...	0.416	Thermo-control.
Corinth, Miss.	6	...	None	1942-3	3,300	...	...	...	0.416	Data from letter.
Tupelo, Miss.	11	...	None	1942-3	2,800	...	...	...	0.488	
Total	33								0.423	Weighted average for 33 units.
Coulee Dam, Wash. Contractors Camp	12[8]	2,310	None	1937-8-9	5,820	4.0	1.73	6,425	0.478	Sw. control portable units.
	127[9]	4,600	None	1934-5	5,560	13.5	2.93	11,350	0.444	Sw. control portable units.
	88[10]	6,800	None	1934-5	5,560	16.5	2.43	14,100	0.373	Sw. control portable units.
TOTAL UNITS	227	5,330*				14.2	2.67	12,150*	0.419	Weighted average for 227 units.
Government Town	76	7,340	...	1943-4	6,420	15.0	2.05	20,800	0.433	Furnace conversion sw. control.
									(0.453	USBR engineers figure.
Tacoma City Light	8	11,560	...	1938	5,059	15.0	1.30	26,630	0.500	Basement units.
				1941-2-3	(50 yr. av.)					
Helena, Mont., Gas	20	6,365	W-C-D	1943-4	8,076	21.3	3.33	25,000	.487	New homes, basement gas furnaces.
						(Electrical Equivalents.....)				
Boise, Idaho	...	10,000	W-C-D	1938-9	5,403	4.8	0.48	7,793	0.144	Coef. of performance 3 1/3.
Reverse Cycle Job	1	...	...	1943	5,738	4.8	0.48	8,550	0.148	Thermo-control panel heat.

* Weight average.
[1] W—Walls; [2] C—Ceiling; [3] D—Doors and Windows.
[4] Part.
[5] Average.
[6] Assumed.
[7] Demand.
[8] A-size.
[9] B-size
[10] C-size.

If we can build a house that has a factor of 0.25, we can economically use electric heat. We cannot use electric heat satisfactorily where the factor runs much over 0.35. Therefore, to keep the consumption within this range, we must build for this load. In climate as severe as Spokane, where the average is 6,323 degree-days, it is obvious that we must insulate all parts of the house. We must fill the walls and ceilings with insulation, use double sash and doors, and obtain a good vapor seal. We found we had to control insulation and application in order to have a satisfactory water heating service; likewise, we must control insulation and application in order to have a satisfactory electric house heating service.

Unsatisfactory experience with electric house heating, causing the withdrawal of such rates by the utilities, was due in part to the fact that no control was exercised over the construction of the houses or the methods of use. Certainly early comments and conclusions, based on a use of 0.8 kwh. per degree-days per 1,000 cu. ft. of house, would be changed if that use by proper application could be brought within the range of new homes built for this service with a heat factor of approximately 0.25.

Table I—Compilation of widespread electric house heating data for purpose of "heat factor" comparisons

Table II—Electric house heating study showing estimated energy consumption data for Spokane area using different "heat factors" and severity of winter

From this information assembled in Table I, we have developed Table II. It is anticipated that a salesman can take this table and discuss the probable electric consumption with a customer, and be reasonably sure he is approximately correct in his quotations. The monthly consumption figures can be deducted from the yearly figure by applying the

Table II

House	Contents In cu. ft.	Mild Winter 5,000 deg.-days Heat Factor	Mild Winter 5,000 deg.-days Kwh.	Average Winter 6,000 deg.-days Heat Factor	Average Winter 6,000 deg.-days Kwh.	Cold Winter 7,000 deg.-days Heat Factor	Cold Winter 7,000 deg.-days Kwh.
Small House (5 room)	5,000	0.3	7,000	0.3	9,000	0.3	10,500
		0.4	10,000	0.4	12,000	0.4	14,000
		0.5	12,500	0.5	15,000	0.5	17,500
Medium House (5 room)	8,000	0.3	12,000	0.3	14,400	0.3	16,800
		0.4	16,000	0.4	19,200	0.4	22,400
		0.5	20,000	0.5	24,000	0.5	28,000
Large House (6-7 room)	15,000	0.3	22,500	0.3	27,000	0.3	31,500
		0.4	30,000	0.4	36,000	0.4	42,200
		0.5	37,500	0.5	45,000	0.5	52,500

NOTE:
Heat factor 0.3 could be attained on new construction by insulating walls and ceiling and using double doors and windows, and with thermostatically controlled room units.
Heat factor 0.4 could be attained on new construction, as above, but with central heating plant in basement.
Heat factor 0.5 would result where walls are not insulated, but ceiling is insulated and heat generated in central plant.
Where actual contents of house can be secured, proceed as follows:
1. Measure outside area of floor to be heated.
2. Measure from underside of floor joist to top side of ceiling joist.
3. Multiply (1) × (2) and add second floor contents, if any.
4. Season Kwh = heat factor × degree-days × cubic contents.
5. Season Kwh. = 0.3 × 6323 × cubic contents for Spokane.

1. Measure outside area of floor to be heated.

percentage of monthly degree-days to the yearly degree-days for any locality.

For Spokane, these percentages are as follows:

September	3%
October	8%
November	13%
December	16%
January	18%
February	16%
March	12%
April	8%
May	4%
June	2%
TOTAL	100%

The heat factors listed in Table II have been purposely quoted a little high for the type of house named. It is felt that if our yearly estimate is high, the customer will be better satisfied with his electric bill for the heating part of his load. Also, this table is more or less theoretical and lacks actual field checks. It should therefore be revised as soon as possible to conform to these checks as they become available.

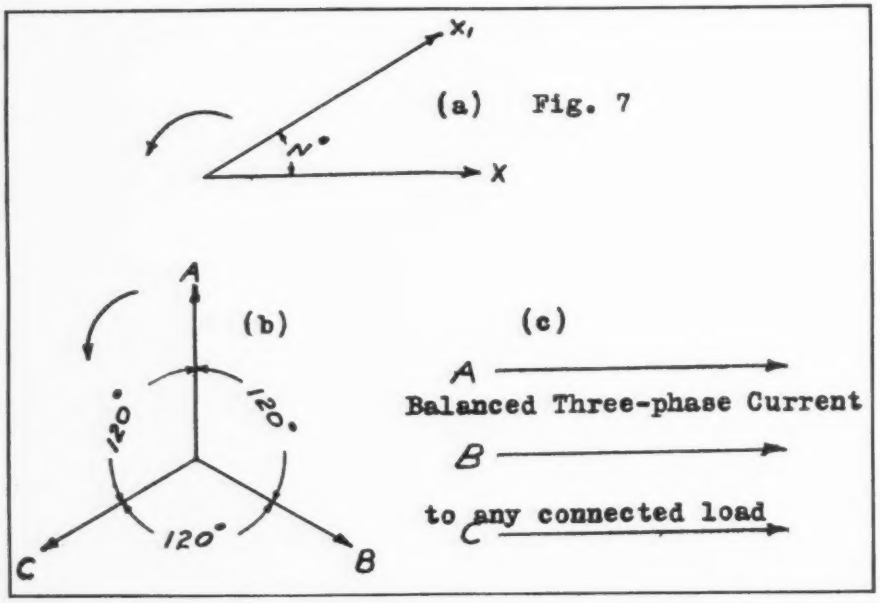
The author would welcome criticisms of this newly developed "heat factor," and would appreciate any comments on its application. We would especially like to get more data in climates above 6,000 degree-days, and for localities where the temperatures reach zero or lower.

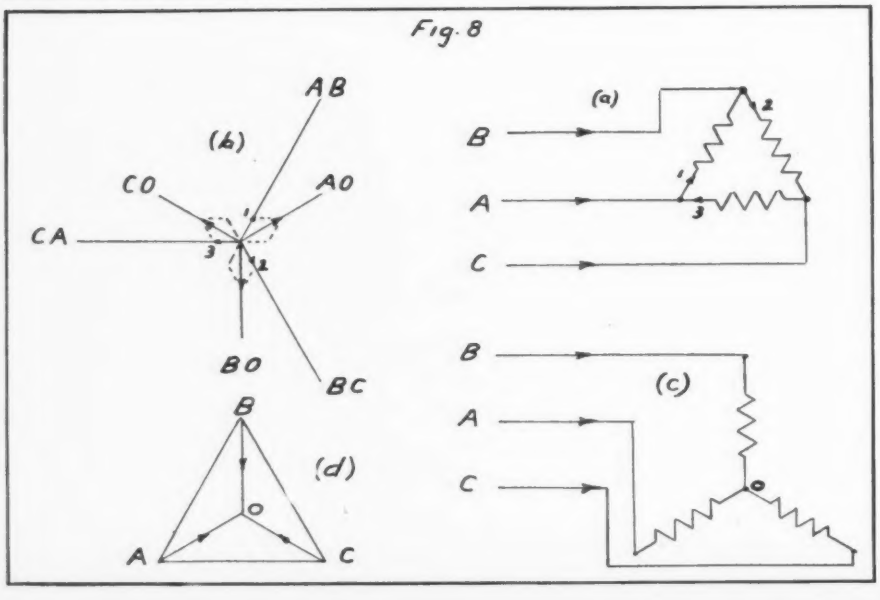
Transformer Connections — II Vectors

Second in a series of four articles dealing with transformer connections and the resulting voltage and current relations

F. V. Gillum

Southern California Edison Co., Pomona





TO PROPERLY understand the "banking" of transformers, one should have a working knowledge of a few fundamentals of vector analysis as applied to alternating-current circuits. Accepted engineering practise calls for a counter-clockwise rotation of vectors. Thus, in Fig. 7a, vector (XI) is drawn (N) degrees in a counter-clockwise direction from vector (X). Therefore (XI) is said to be leading (X) by (N) degrees.

Alternating currents and voltages are best represented by vectors, which are simply lines whose length is proportional to the magnitude of the quantities represented. The relative position of vectors, when considered as spokes of a wheel, indicates the angle of lead or lag between the quantities represented. Fig. 7b is a vector diagram of the three-phase currents flowing in three-phase circuit, Fig. 7c. Phase-rotation is A-B-C. This means that B phase current passes through a positive maximum one-third of an electrical cycle (or 120°) after A phase current passes through it's positive maximum. C phase follows B phase by another 120°. This is shown in Fig. 7b, representing a balanced circuit. The three-phase currents being equal in magnitude, the vectors are equal in length. A phase leads B phase by 120° and lags C phase by 120°.

In Fig. 8a, a delta-connected load is supplied from a three-phase power line. Fig. 8b is a vector diagram of the voltages and currents of this circuit, assuming a balanced, unity power-factor load. The current vectors are shown with arrows. The voltage vectors are not supplied with arrows as the label on the vector indicates it's direction. Thus the voltage vector AB

Fig. 9

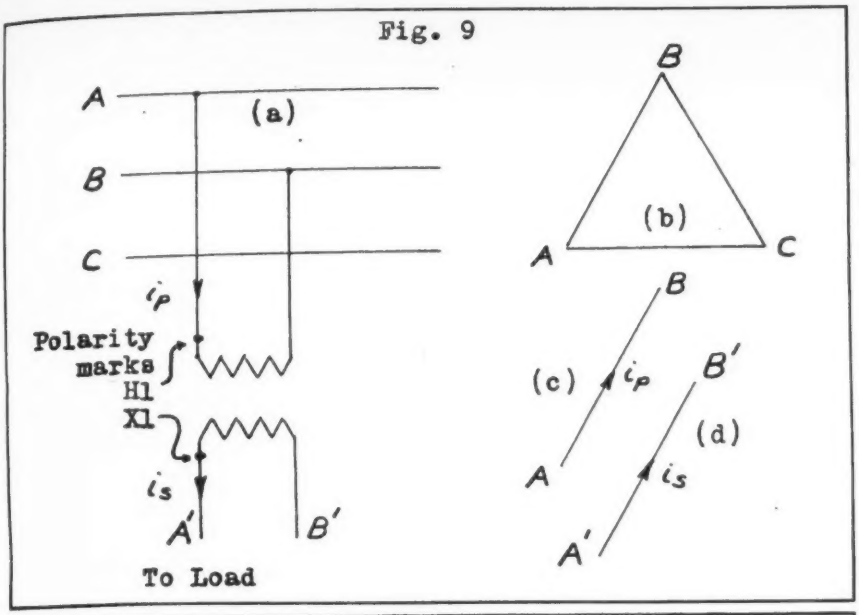
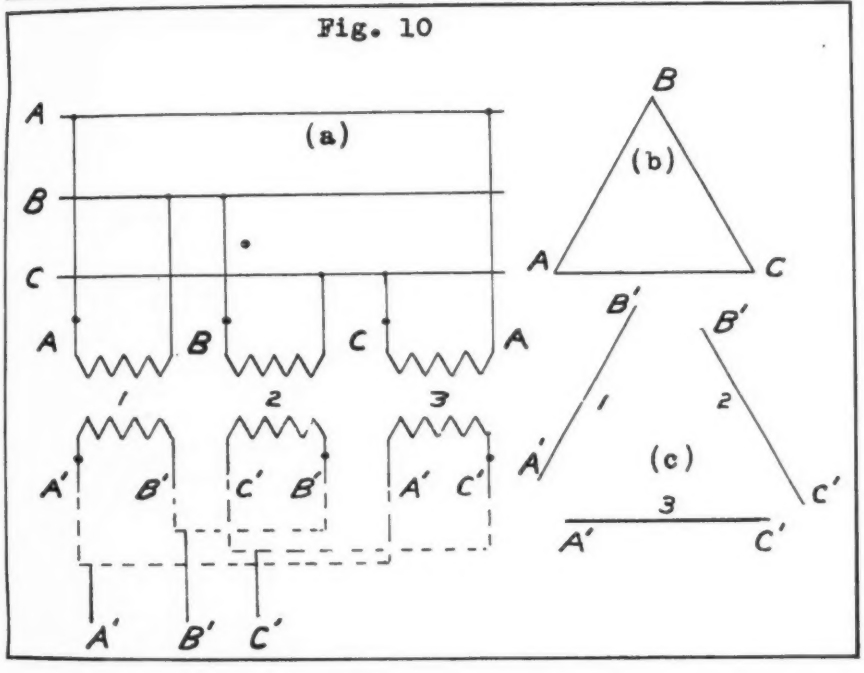


Fig. 10



represents the voltage impressed on that portion of the load connected between A and B. The current in this portion of the load is represented by arrow and vector 1 and can be said to flow from A to B and is in phase with the voltage AB. Load currents 2 and 3 are represented on the diagram in a similar manner. The total line current in the phase wires A, B, and C is found by vector addition of the component load currents. For example, A phase current equals current 1 minus current 3 and is in phase with the voltage AO. Fig. 8c shows a star connected load, and Fig 8d shows the vector relations between the currents and voltages. If the reader carefully compares Figures 8b and 8d, he will find they are identical, in so far as the magnitudes and phase angles of the quantities represented are concerned. Either form of diagram may thus be used, irrespective of whether the load is star or delta connected. The form of diagram shown in Fig. 8d is preferred by many engineers and is easily understood when applied to three-phase transformer bank connections, and will be subsequently used.

Fig. 9a illustrates a single, subtractive polarity, transformer connected to A and B phase wires of a three-phase circuit. Fig. 9b is the basic vector diagram of the three-phase voltages. The current Ip flowing into the transformer at the polarity terminal is in phase with the voltage AB impressed on the primary winding, (Fig. 9c). In phase with this current, is Is, flowing out of the polarity terminal of the secondary winding. The voltage causing Is to flow into any connected load is A'B', (Fig. 9d).

In Fig. 10 are shown two additive transformers added to the three-phase power supply, in addition to the subtractive unit of Fig. 9. Note that secondary phase markings A'B'C', follow through the transformer on the polarity marks, direct from the primary ABC. Fig. 10c is the voltage diagram of secondary voltages, "exploded" to show more clearly the component voltages. Note that vector A'B', being in phase with AB, is drawn parallel to, and in the same direction as AB. The other vectors are located in their proper position with respect to the primary voltage vectors. Inspection then reveals the proper connections to be made to complete the delta. This is done as shown in Fig. 10a by the dotted lines.

Third in the series on Transformer Connections will cover transformer banking.

FM Overcomes 2500 Foot Line-of-Sight Discrepancy

FREQUENCY modulation, two-way radio-telephone communication proved the answer to a difficult dispatching problem when officials of Telluride Mines, Inc., called in General Electric engineers to conduct tests. The mining company operates two hydroelectric plants in connection with mining operations at Telluride, Colo. Speedy and dependable communication between either power house and its water source is imperative.

The tests proved that the FM system would furnish reliable communication under the adverse conditions of a severe thunder storm, followed by a blizzard, and a line-of-sight discrepancy of 2,500 ft. The line-of-sight discrepancy due to intervening mountains proved no barrier because of a slight bending and multiple reflection of the FM waves.

All-Electric Rate Boosts Water Heating

Experience of Seattle City Light with all-electric residential rate is cited to show how this and other influences have aided in standardization of size and wattage of hot water tanks on this municipal system

Fred Knaus
Industrial Sales Engineer
Seattle City Light

SEATTLE City Light's all-electric residential rate now in effect nearly five years has produced one very gratifying result not entirely anticipated. It gave a break to water heating. This $5 minimum all-electric rate, placed in effect in July of 1940, not only has attracted more than 17,000 customers with yearly revenue of $80 and average annual consumption of 7,400 kwh. plus, but has provided Seattle City Light with a means of bringing about some semblance of standardization of tank and wattage of water heaters. Shotgun methods of approach to the water heating problem with the public the victim have been eliminated.

If there has been one crying need for standardization of domestic utilization equipment in recent years, it has most certainly been in the field of electric water heating. Hardly any two operating properties have been able to agree upon tank size, type of heater and wattage. Need for standardization to reduce first cost is all the more pressing as the postwar era looms closer.

A reduction in residential rates was about to be made in 1940. The proposed rate drawn up by the rate experts in the engineering division looked good on paper and when plotted, but indicated that there would be a loss in revenue in the lighting bracket, with some of this loss shifted to the range and water heating steps, leaving these customers with practically no saving. In effect, this was an increase in the cost of cooking and water heating from a load building standpoint. This is a weakness that invariably creeps into a rate schedule which is the result of "tinkering" by rate experts who have had no load building experience.

In the sales division it had been felt for years that a home equipped with an electric range was also entitled to have some means of heating water besides furnace coils which would furnish an adequate supply at all times and at a competitive cost increase. It was felt, too, that a clean-cut 100% electric use could be obtained if the cost was right.

The time seemed opportune and the all-electric rate was pulled out of the hat as an optional load building rate and as a substitute for deficiencies that were apparent in the standard rate. Those closest to sales were the most enthusiastic over possibilities of an all-electric rate. The proposed rate, which was placed in effect on July 15, 1940, was an follows:

$5 for first 370 kwh. or less
(12 months a year)
7/10c for all over 370 kwh.

No opposition to the rate was offered by the engineering division but the general feeling was that the $5 minimum each and every month of the year without exception would kill it. If it was accepted the city would be assured a revenue of $60, plus, per year. No harm could result as the customer would earn the rate only when the city received the revenue. Perhaps the sales division's contention that sale of tanks would increase might materialize.

By comparison with the city standard rate (see box), the all-electric rate is highly competitive with other methods for heating water. The all-electric rate had then removed the only obstacle in the path to the objective of an all-electric home exclusive of space heating. What happened in the ensuing years as a result of the all-electric rate is an interesting story.

At the close of the year 1944, the city had about 17,000 (16,148 av.) all-electric rate accounts with an average yearly consumption of 7,438 kwh. and an average annual revenue of $79.96, as shown by Table I. Sales of factory-built tank assemblies had increased by leaps and bounds and by the end of 1944 this type of heater had largely displaced side arms and other types, bringing about a very much desired degree of standardization. The situation with respect to number and type of water heaters and the rate they were on at the time the all-electric rate went into effect is shown in Table II. This same table shows the situation as of Jan. 1, 1945, four and one-half years later and indicates the effect of the all-electric rate plus sales effort in bringing about greater standardization.

However, this table does not reflect the true picture with respect to the all-electric rate since the government limited the manufacture of tanks to 30-gal. size for about two years and there was nothing the customer or the city could do about it. At the present time, and since the restriction on tank size has been lifted, the city again controls the situation, as all purchasers demand tanks which will qualify for the all-electric rate. Dealers are cooperating and nearly all tanks being ordered for distribution in the city are 52 gal. or larger.

Results can best be told by recounting some of the salient facts. The 3¼ rate for water heating on a separate meter which had been in effect for about six years prior to the all-electric rate was giving customer satisfaction but was fast becoming a nuisance and not producing the kilowatt-hours ex

Residential Rates

Sept. 1, 1939, residential rate was:
4½c first 40 kwh.
2c next 180 kwh.
¾c all over 220 kwh.

July 15, 1940, residential rate was reduced to:
3½c first 50 kwh.
2½c next 40 kwh.
2c next 100 kwh.
¾c all over 190 kwh.

July 15, 1940, the "All Electric Home" rate was also placed in effect, amounting to:
$5.00 for first 370 kwh. or less
7/10c for all over 370 kwh.

April 1, 1944, residential rate was reduced to:
3.2c first 60 kwh.
2.0c next 140 kwh.
¾c next 2300 kwh.
9/10c all over 2,500 kwh. per month

Optional rate for metered water heating:
¾c per kwh. Minimum $1.00

Optional rate for flat rate water heating:
$4 per kw. of heater capacity per month
Guaranteed monthly minimum of $2.40 for a period of not less than four consecutive months

All Electric Home rate was also reduced to:
$5.00 for first 400 kwh. or less
7/10c for all over 400 kwh.

Table I

	Standard Rate	All-Electric Rate
Average number consumers	71,984	16,148
Total kwh. used	165,954,843	120,105,602
Total revenue	$3,094,833.57	$1,291,168.91
Average kwh. per consumer	2,305	7,438
Average revenue per consumer	$42.99	$79.96
Average revenue per kwh.	1.865c	1.075c

NOTE: 18% of customers constituting all-electric group used 42% of total kwh. and provided 29% of total residential revenue.

pected. Considerable expense involving both the customer and the city was entailed by the installation of the separate wiring and meter and often separate service. The city was spending a lot of money and perpetuating the expense of keeping the account in order to give the customer a lower water heating rate. It also had a tendency to emphasize the 63% average of the total kilowatt-hours used for water heating (see Table III).

Side arms supplementing furnace coils were going in much more frequently than tanks prior to the all-electric rate. There was and had been for 20 years a flat rate of $4 per kilowatt-month water heating rate. This furnished unsatisfactory service when applied to the intermittent use characteristics of the home and netted a low rate per kilowatt-hour and, moreover, was on peak. Fortunately, this service never grew to any proportions and installations have now been reduced to about 250. None of these setups was considered the answer to an adequate system which would convert all the potential load to kilowatt-hours.

What the all-electric rate did was to immediately reverse the trend of sales to comply with the new rate set-up and for 2½ years the sale of other than 40-gal. or larger automatic tanks was negligible. Probably not a dozen side arms and not a single 30-gal. tank were sold during 1941 and 1942. However, people who had spent money for some type of electric heater could be expected to be slow to change, and that is why the city still has 15,000 side arms and 250 flat rates. Moreover, no attempt was made to replace these heaters as that will come gradually, without effort, upon failure of the equipment. Only about one-fourth of tank sales replaced other types of heaters.

The feeling is that with the all-electric rate, saturation will be approached very rapidly in certain areas as use to date predominates in the humbler dwellings and, of course, in new homes. Areas containing 1,300, 900, 500 and many of 200 and 300 homes are 100% all electric, with the exception of air heating. Some meter reading routes consist almost exclusively of all-electric accounts.

Of the city's 88,000 residence accounts, approximately 19,000 have automatic tanks of some type. About 17,000 of these were on the all-electric rate at the close of 1944. In addition there are some 3,000 homes in permanent housing projects which are 100% all electric, but for the present are metered on the primary and therefore not considered as residential accounts. They are included, however, in a total of approximately 22,000 automatic tanks supplying hot water for domestic purposes. Kilowatt-hours have increased from an average of 1,492 per residence customer in 1939, to an average of 3,246 in 1944. Revenue has increased from $35.56 average per customer in 1939 to $49.77 in 1944, and at the same time two rate reductions have been absorbed.

At the time of inauguration of the all-electric rate there were around 3,000 twin-unit automatic tanks in service on the city's lines. These customers had been obtained over a period of six years of sales promotion consisting of extensive advertising on billboards and by bill stuffers along with considerable effort on the part of the city's sales force. All of this promotion stressed the value of automatic hot water in the home. *Dealer sales were negligible.*

The new optional all-electric rate was about a 20% saving for the larger users with less and down to no saving for lower use customers with separate meters for tanks. The change-over of 3,000 original tank customers to the all-electric rate was gradual at about 250 per month with about half removing furnace coils.

The last six months of 1940 under

Table II

Situation at Time of the Inauguration of the All-Electric Rate	No. of Water Heaters	Type	Rate
STANDARD RESIDENCE (One Meter) SINCE Sept. 1, 1939, had been 40 kwh. @ 4½c 180 kwh. @ 2 c All over 220 kwh. @ ¾c	19,000	Side Arms	Standard res. rate (1 meter)
	2,000	30-gal. twin unit automatic tanks	Separate meter @ ¾c per kwh.
	500	40-gal. twin unit automatic tanks	Separate meter @ ¾c per kwh.
Automatic tanks were permitted on separate meters at ¾c per kwh. with minimum of $1 per month. There was also a flat rate $4 per kw. month for water heating.	500	40-gal. twin unit automatic tanks	Standard residence rate
	600	Flat Rates	$4 per kw. month
JULY 15, 1940, STANDARD RATE REDUCED TO 50 kwh. @ 3½c 40 kwh. @ 2½c 100 kwh. @ 2 c All over 190 kwh. @ ¾c			
Automatic tanks were permitted on separate meter at ¾c per kwh. with minimum $1 per month. Also $4 per kw.-month for water heating.			
Optional all-electric rate, 370 kwh. or less per month $5; all over 370 kwh. at 7/10c (one meter)			

Situation End of 1944			Situation at End of 1944	
STANDARD RESIDENCE RATE (One Meter) 60 kwh. @ 3.2c 140 kwh. @ 2.0c 2,300 kwh. @ ¾c All over 2,500 kwh. @ 9/10c	15,000		Side Arms	Standard res. rate (1 meter)
	750		30-gal. twin unit automatic tanks	Separate meter @ ¾c per kwh.
	1,750	Defense Homes—Tank capacity limited by government	30-gal. twin unit automatic tanks	Standard res. rate (1 meter)
ALL-ELECTRIC RATE 400 kwh. or less per month $5 All over 400 kwh. @ 7/10c	3,000		30-gal. twin unit automatic tanks	Primary rate
	17,000	Est. 1,250 Est. 11,750 Est. 4,000	30-gal. twin unit automatic tanks 40-gal. twin unit automatic tanks 52 and larger unit automatic tanks	All-electric rate
	250		Flat Rates	$4 per kw. month

Table III, 50 Accounts—Groups of 10—Kwh. One Year

Separate Meters on Tanks, Coils Out of Furnace

Group	Kwh. Lights, Ranges, etc.	Kwh. Tanks	Total	Tank % of Total	Kwh. One Meter Year Following on All-Electric Rate
1	20,513	38,122	58,635	65	60,338
2	25,525	45,466	70,991	64	65,668
3	22,108	39,494	61,602	64	65,007
4	27,458	42,300	69,758	61	64,892
5	22,156	35,397	57,553	61	57,162
Totals.....	117,760	200,779	318,539	63	313,067
Av. per customer per month	196@ 4.64c $7.15	335@ ¾c $2.51	531@ 400@$5 131@7/10c $5.91	63	522

Cost of water heating under all-electric rate was $5.91—$4.64, or $1.27

(Note: Since customers were already All-Electric, rate reduction did not produce any increase in kwh., but saved city in capital investment and general expense.

the all-electric rate duplicated the past six years in tank sales with about 500 per month and with considerable increase in kilowatt-hours on old sales due to a provision in the rate requiring removal of furnace coils to qualify. The average gain here was found to be around 1,200 to 1,500 kwh. per year.

Hundreds of customers changed directly from a small 50-kwh.-or-less-per-month consumer, using lights, wood and coal or gas range with coils for hot water, to a consumer using 400 to 600 kwh. per month. Others who were already using the electric range but had coils in the furnace immediately added the automatic tank and permitted the removal of the coils to qualify for the all-electric rate. Some who had been using side arms, of which there are still about 15,000 in summer and in conjunction with furnace coils in winter, junked both to get a better service and rate. There were also range sales where the desire for automatic hot water was responsible for the sale of the range. *Dealer sales exceeded those of the city.* These cases are mentioned merely to emphasize the value of a come-on rate which will eliminate piece-meal sales extending over a period of years, by substituting a rate which gives the customer an inducement to go all the way.

Of the original tanks, about 2,500 were on separate meters, though few customers benefited by this, except at vacation time and then only by a small amount since they reached the ¾c bracket (190 kwh.) on the house meter. It had been the slogan with salesmen to talk about the special ¾c rate and most sales were closed on that basis and turned in with the notation "customer wants separate meter," and that is the way it went in. This group has now been reduced to around 750. All others have had the load combined and have qualified for the all-electric rate. Of the remaining 750, there are a few who do not have electric ranges and some who have low consumptions, but for the most part they cannot qualify for the all-electric rate as their tanks fail to supply sufficient hot water on wash day to permit the removal of the furnace coils. These 750 are among our first sales not many years ago with a preponderance of 30-gal. tanks. The all-electric rate was extended to customers with 30-gal. tanks, if purchased before the rate went into effect and if qualifying otherwise.

This verified our past experience with 30-gal. twin-unit tanks. They had caused the greatest part of water heating complaints and led to the insertion in the all-electric rate set-up of a minimum requirement of a 40-gal. twin-unit tank. This had the effect at the time and until the manufacture of large tanks was restricted, of practically eliminating the sale of the 30-gal. tank.

With the advent of the automatic washing machine, complaints of insufficient hot water began to appear where 40-gal. tanks had been installed. The city's policy immediately changed to that of encouraging the use of the 52-gal. size as a minimum for home use. This experience taught us, that if we wished a satisfied customer, not to sell or recommend a 30-gal. tank. Also, if we wished a satisfied customer over a period of time, not to sell or recommend a *40-gal.* tank. It has been found that tanks satisfactory at time of purchase may be inadequate a year or two later, or for the family of some new owner. Another lesson learned is that recovery is not equivalent to a ready supply.

The 52-gal. tank with 2,000-watt top element and 1,000-watt bottom element at present appears to give satisfactory service to all but the highest water user group. With the use of the larger tank more work could be given to the upper element by lowering it to about one-third the way down from the top, since quick recovery is no longer a necessity. This gives less work for the lower unit and permits the use of a minimum wattage without becoming a flat rate. Temperature controls also enter into this distribution of the work. An attempt is made here to sell all tanks at 135-140° for the upper and 145-150° for the lower element. Excessively high temperatures quite often cause high bill complaints.

Utilities may not be able to determine years ahead what the character of their load curves will be. Control may become simple and be of great value. In any case, whether the outage is from system failure or control, the larger tank would have the advantage. The high wattage single-unit tank, though creating a high morning peak, has the advantage of bringing a high percentage of tanks into the evening peak fully charged. This advantage should not be ignored in the twin-unit tank by reducing the total wattage too much. A combination of the good features of both should be incorporated into the twin unit.

Many tests made on 52-gal. tanks in the highest 15% consumption group indicate that the top element is rarely on during peak hours. There have

Table IV

No. of Homes	Gal.	Type of Tank —Watts—	Yearly Load Factor %	Highest Demand 1944 Max. Demand per Unit
500	30	1,500 Upper 1,500 Lower	46	2,280
900	30	1,500 Upper 1,250 Lower	48	2,180
600	30	1,500 Upper (1,250 L.—300 (1,000 L.—300	50	2,080
700	30	1,000 Upper 600 Lower Interlocking	52	1,875
868		Ranges, lights and refrigeration only	26	1,200
304		Private group—secondary metering—Ranges, lights, and refrigeration only	23	1,280

been many cases where a 40-gal. tank with 2,000 watts top and 1,000 watts bottom failed to give satisfaction, but where a 52-gal. tank with the same elements eliminated all need for any change in routine of family living, which after all helps to sell tanks.

The idea behind the statement that the wattage should not be decreased too much, stems from the thought that there is no point in having the lower heater go through the peak solid. There is always a percentage of homes where large quantities of water have been used in the early part of the day and then the family goes out for dinner. In this case the tank with proper recovery may become fully charged and be completely off during peak hours, except momentarily for radiation. This recovery idea must not be carried too far, however, as there is a tendency to create local transformer trouble, not on winter peak hours, but on Sundays and holidays between 11 a.m. and 2 p.m. One hundred per cent saturation of single-unit tanks on a residence feeder could cause serious trouble all the way back into the substation on one of these days.

There is a definite indication that the demand increases with increase of wattage of the lower element. This demand is further influenced by the probability of the upper element coming in on the peak. What the distribution system will be called upon to deliver per home in a 100% saturated area can be pretty well gathered from the load curves of Fig. 1 and Table IV.

To supply hot water for domestic needs alone, opens up a tremendous field for load building. That water heating is desirable business from the standpoint of kilowatt-hour cost delivered as compared with other uses has long been recognized. To sell these kilowatt-hours in volume, however, the service must be satisfactory as well as low in price.

Water heating service to be most profitable to the serving utility should possess the most desirable load characteristics obtainable consistent with lowest investment and operating costs. Seattle City Light feels that with the all-electric rate and by encouraging use of the 52-gal. tanks it is giving the public the best service possible at a competitive cost and at the same time improving its load characteristics. This sums up to saying that our present objective is a 52-gal. twin unit tank, 2,000 watt top and 1,000 watt bottom, independently controlled to be installed in every home with electric range and under the all-electric rate.

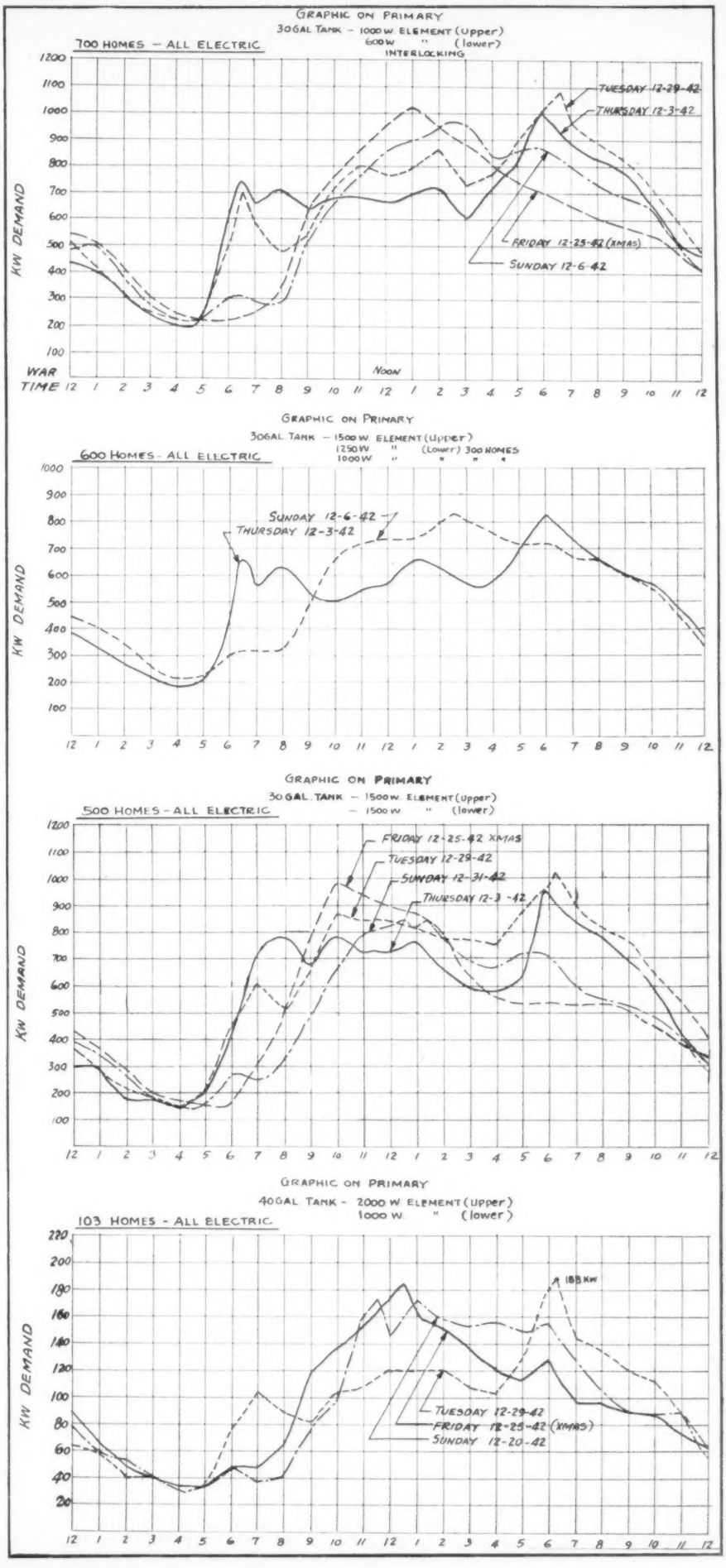


Fig. 1—Primary load curves for different tank sizes and wattage of elements indicating load characteristics with high water heating and range saturation

Taylor McKay Mayer

Dick Chamberlain

Cluff Johnson

They Scan the Horizon Beyond the War

Northwest Electric Light & Power Assn. Utilization Section exchanges members' plans, methods, ideas on load reconversion and sales

"ONE good salesman with an order book can create more jobs than any group of planners who just sit and plan." With this plain fact T. E. Roach, vice-president for Oregon, Northwest Electric Light & Power Assn., and vice-president and general manager, Northwestern Electric Co., opened the concentrated, compact, wartime annual meeting of the Utilization Section of that association at Portland, April 17-18. "With war loads disappearing, we will soon have to sell again. Some 900,000 kw. of load, as much as the total prewar load itself in this region, may disappear. We will need to dispose of this electricity in ways to bring the greatest benefit to all, not merely to dispose of it. By its wise use we can create more jobs. This may take many new ideas, even a revamping of all sales departments, but it is an opportunity for all of us to lead in the re-employment of 20% more people than were employed prior to the war."

With a program well balanced in all phases of pending commercial development for all branches of the industry—industrial, commercial, lighting, appliances, house heating, agricultural electrification, dealer coordination, wiring—Arthur H. Wegner, Washington Water Power Co., chairman of the section, provided participants with a stimulating, terse and yet comprehensive sweep of the horizon beyond the war. It was not a meeting of addresses or papers but of thought, method and idea exchange. Into the pool all freely tossed their own and their company's ideas and data, and from this enlarging pool each took back to his company more than he gave.

Pat Johnson, chairman of the association's electrical development committee, had Henry Kruse, also Puget Sound Power & Light, report for C. T. Bakeman, who was in the East, on the work and importance of the industrial development committee. Kruse explained the background of national newspaper and magazine advertising sponsored jointly by several Northwest power companies to attract industry to the region. It was to implement this advertising that the committee was set up to exchange ideas, combine promotional facilities and gain leadership in community industrial conversion. He mentioned studies and conferences on light metals fabrication and casting, a post-victory products survey of Washington industries and a study of possibilities for the substitution of light metals and alloys for other materials in the various products manufactured throughout the country.

What fluorescent lighting could and might do to power company loads if an aggressive promotion program on lighting is not undertaken as soon as possible was told by Walter E. Potter, in a rapid-fire review of a recent survey conducted by General Electric Lamp Department with the help of utilities throughout the nation. The survey showed that in five intense years lighting levels had been raised more than during 20 years with incandescent lighting. The over-all averages showed a 7.9% drop in kwh., however, and installations are running 10% less in kw. for interiors and 17% for window lighting than formerly. Other results from the survey, given in machine-gun rapidity, have been promised for early publication in ELECTRICAL WEST, possibly with a Western breakdown.

Commercial and industrial sales plans of Northwest companies were set up for scrutiny by John Plankinton, Northwestern Electric, who was ringmaster for this discussion period. He prefaced with observations that war had accelerated many phases of electricity utilization in this field, particularly industrial lighting, electronic applications and electric cooking.

Orland Mayer, Idaho Power, said that his company's program would vary with the stage of development of the dealers who serve its customers. Customers, he felt, are entitled to complete service and when dealers can render that service they should be encouraged. When not capable, they should be encouraged to develop to that point. In small communities, the company might have to sell equipment, but in larger ones its efforts would be entirely promotional.

John Taylor, B.C. Electric Railway, declared the problem more complicated in his company, because it sold both gas and electrity and because in Canada equipment costs are much higher than in the United States. T. N. Hoss, Portland General Electric, said his company, selling no equipment whatever, would reactivate its department and increase personnel from men returning from the armed services.

All agreed that the commercial-industrial heating committee be re-established, although some felt two committees would be necessary because of new techniques and methods—dielectric and induction heating—for industrial applications, and a commercial cooking committee for the training of new men in that field.

Both Henry Kruse and Orland Mayer described surveys made by their companies to assist their local industries, particularly the smaller ones, to convert to civilian production and expand their products and markets. Articles detailing the methods and value of such work are promised for early publication.

D. O. Bergey, Northwestern Electric, gave a quick sweep of the electronics

field, stimulating the imagination as to its possibilities, and ended by stressing the need for special training of industrial salesmen, even though many ex-army radar men might have a rudimentary basic knowledge that would be useful.

Dealers and the Market

Pat (Two-Suit) Johnson, Puget Sound Power & Light, prefaced the afternoon session devoted to dealer coordination, water heating and house heating, with a summary of a previous day's meeting of the company sales managers to determine what would be sold in the five Pacific Northwest states and British Columbia in the first five years after the war. He said most companies expected to double kilowatt-hour consumption, in many cases to 4,000 per customer, and raise average residential revenue to $50 and above. The estimated total of ranges to be sold was 300,000, water heaters 200,000 and refrigerators 400,000, as well as similar quantities of all other appliances and many new ones such as home freezers, automatic laundry. Practically all would be sold by dealers.

In the absence of W. C. Mainwaring, who was carrying on Canada's Eighth Victory Loan drive in western Canada, John Taylor, B. C. Electric, conducted a session to exchange views and policies regarding company merchandising, dealer development, sales training, sales promotion and financing. Speaking for his own company, Taylor said it intended to remain in direct selling in a limited way. He explained that saturation as yet was low and the market needed further company development. The company's dealer plan has not been completed as yet, but it is working closely with both a dealer and a contractor organization in making those plans. He outlined various helps planned for dealers, sales training classes proposed and a continuance of advertising subsidy. He said later that dealers spent $7 for each dollar the company paid in such cooperative advertising. Wiring, however, would not be subsidized.

Puget Sound Power & Light, said Pat Johnson, will not merchandise outside of Seattle. In Seattle it will do whatever City Light does. He also made a point that prior to the war the power company sales departments had fine relations with a limited number of manufacturers and distributors, but that in the future it would be necessary to extend their contact and assistance to a much larger number.

Northwestern Electric has been out of merchandising for a long time and will remain so, said Plankinton, but dealer helps will be increased.

Montana Power, said D. J. McGonigle, will not merchandise, not even lamps. This is new policy. The company is now working on a program of more energetic dealer coordination.

Idaho Power has never gone out of merchandising, said R. S. Overstreet, but the last selling year it only did 6% of the business, while dealers did 94%. Because of extensive rural areas where dealers do not go for business, the company feels it must carry on, leading the dealers to develop this type of business too.

Pacific Power & Light, said D. B. Leonard, has discontinued merchandising, but he felt that there was an obligation to customers to provide utilization equipment, if no one else did, and to see that service was performed. The company will maintain service centers at each office, where a few small appliances may be sold, but major effort will be to assist dealers to sell through demonstration of equipment to customers.

Eastern Oregon Light & Power, declared Leon Gray, is not going to merchandise. Telluride Power, Richfield, Utah, according to W. O. Cluff, will continue to merchandise because of scattered territory and lack of sales coverage. If dealers in some localities can do the job, he said, it would not merchandise.

Washington Water Power is going to find out before it makes any decision, said R. B. McElroy, who has just been assigned the entire dealer coordination program for that company. Right now it is carrying on a unique survey of every dealer, conducting it with care to see that it is not prejudiced in any way, to find out whether dealers really want the company to cease merchandising or not, and exactly to what extent and in what fields. Likewise it will find out what helps dealers really want and will employ, and which they do not want. This survey is now being conducted, and McElroy promised that the results of it would be made public when completed and published in ELECTRICAL WEST.

McElroy also questioned the too optimistic figures of market potential, saying, "We have to get out of our minds the idea that people are going to break the hinges off the doors to come in and buy new appliances. These people who sell must be prepared to promote, to have sales people in the field or competition from other businesses is going to get the trade."

Portland General Electric, A. C. McMicken was emphatic in saying, would continue its highly successful policy of not merchandising and of dealer promotion and assistance. It would continue advertising allowances which had resulted in making electric appliance advertising dominate every newspaper in the territory. Dealers had increased their own advertising with this help by 660%. In the past the company had made available to dealers who wanted it, EH&FA financing and, although it did not furnish wiring, the wiring could also be carried on long terms through this financing. The company also planned to help train salesmen again.

Ready to go is lighting equipment, L. R. Wilson, Walter Potter show the group

Water heater standardization advanced a long step forward at this meeting, when a motion was carried that the companies be asked to declare themselves as willing to accept the EEI-NEMA water heater standards. Ralph Gale, Idaho Power, opened the discussion by reviewing the long and complicated subject. Last year at Boise, J. F. McAllister, Utah Power & Light, had presented a tabulation of member company policies and practices respecting water heaters. This, as well as

Merry Macs, Elroy and Micken

similar surveys for the entire country, showed a majority in favor of two-unit, two-thermostat heaters. Of the estimated 200,000 water heaters which the companies believe will be sold, 149,000 of them would probably be the two-unit type. He felt that time for action had come. A start could be made and if any company had pet ideas, let it pay extra for them, but the majority would benefit from the standardization.

Gale also strongly recommended the establishment by each company for its area of standard installation charges which would include both wiring and plumbing. This will enable many dealers, who do not have installation facilities, to sell water heaters, and customers will be saved complicated negotiations for installation.

While preferring the higher wattage, single-element, single-thermostat type, McMicken said it was so desirable to get the benefit of standardization, in order to put water heaters on a production-line-cost basis, that he would go along. He also said it was only fair to manufacturers to reach a decision so that they would know what to tool for. Plankinton thereupon made a motion to get commitments from each company without further delay. Various manufacturers representatives present were asked for comments — Tom Mellon of Wesix, Paul Fowler of Fowler Mfg. Co., Earl Jones of National Steel, and George Miles, Jr., Westinghouse.

House Heating Is Hot

Introduced by chairman Wegner as the "hottest subject," the big question of the feasibility of electric house heating for the Northwest was handled by A. C. McMicken. Covering much of the same ground as that in his article, p. 47, January 1945, ELECTRICAL WEST, he went on to say that the power companies had to decide whether to serve such load or close the door on it. With all the publicity air heating is getting and with Bonneville Power Administration advocating it glibly, he said he felt it behooves electric companies to try to give it to customers if they want it.

Its feasibility, he went on to point out, depends on the degree days pertaining to the specific area and, from the company standpoint, the cost of power. Portland's average degree days for 1942-43-44 was 4,231. In Montana, Idaho and Utah, he ventured, it would be more. From power cost, Bonneville's rate of $17.50 per kilowatt year put house heating on a service-below-cost basis that should be amended before the business could be really pushed. Installations in the Portland area run from 15 to 20 per month now.

Homer Bender, Washington Water Power, whose article on the subject appears in this issue, p. 76, declared the companies were in the service business and had to serve it. He said that a heat factor, based on kilowatt-hours per degree day per 1,000 cu. ft. would give the answer simply and practically for any area. Others who spoke on the subject were C. Walton Larue, Wesix, who emphasized the necessity to engineer, insulate and carefully install each job. He also spoke of the inherent diversity in the load in each home.

Concluding this discussion, a fact finding committee was appointed to bring back all the data obtainable to the member companies, making load and demand tests and thus aid the policy making committees and executives in decisions respecting this type of business. The committee which Wegner appointed consists of Homer Bender, chairman, R. E. Sinclair, Northwestern, A. N. Hoss, Portland General Electric, J. C. Munro, B. C. Electric, and W. B. Barnett, Puget Sound.

Rural Extensions Everywhere

That practically all of the business managed companies of the Northwest will "run farm lines up every creek" to every farm that wants electric service, was to be concluded from the discussion of rural electrification, led by D. B. Leonard, on Wednesday.

One new project announced was that Bozell & Jacobs, advertising agency on behalf of the member companies, is preparing a comprehensive booklet for wide circulation throughout the nation. Its purpose, outlined by L. F. Van Houten, will be to tell accurately the degree of rural electrification which these companies have already achieved, declare postwar policy, tell of benefits obtained by farmers in the past and foretell those possible in the future from farm electrification. It will be circulated to farmers, business, legislators, schools and newspapers, both by the companies and by the association.

Berkeley Snow, secretary of the association, also discussed its purpose, saying that it had the firm backing of the chief executives of all the companies.

Overstreet, telling that Idaho Power now served 80% of all farms within its extensive service area, said his company felt that, for a small proportion of its present investment, it would "[illegible] back up in the creeks 35 to 40 miles and serve remote farms, even where density was only one to a mile. It will not be content, he said, until it has electrified every chicken house in the area.

. Karl Dimmit, Puget Sound Power & Light director of farm service, told the mechanics of his company's extensive farm program. A point he made was that it was vital that every employee of each company, even to cashiers in branch offices, understand and be sold on the benefits of such a program to the customers and company.

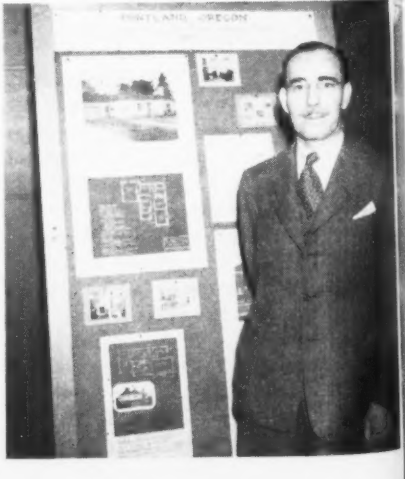
Both W. P. L'Hommedieu and Elbert Kramer of Westinghouse Co., San Francisco and Los Angeles, respectively, spoke of related helps which the company is giving to this field.

In the absence of H. E. Farris, Mountain States Power Co., vice-chairman of the section, Wegner presided also over the portion of the program devoted to miscellaneous topics. D. J. McGonigle described the successful traveling home-planning institutes which Montana Power has participated in throughout Montana, and told the group of his discovery that the lumber companies, in allocating proportions of cost for various parts of a home, only gave 2% to wiring and fixtures, an amount completely inadequate.

Nominated for vice-chairman for next year and who will be in line for chairman the succeeding year, was James McKay, Portland General Electric Co.

To close the successful two-day session, the manufacturers and distributors held a "parade", led by R. G. Chamberlain, Hurley Machine Co. After telling briefly what Thor plans

James McKay, electee



Wegner Plankinton

Taylor, Mellon, Dimmitt, Kruse

Bergey, Hoss, Bender

are for making washers when permitted to do so, he called on other manufacturers' men to do the same.

L. R. Wilson, General Electric Lamp Department, assisted by Walter Potter, led off by showing new light sources all ready for market the minute they can be released. Hugh Bargion, Westinghouse Lamp Division, told of the potential lighting market. Tom Mellon, Wesix, said that a limited number of water heaters and air heating equipment was available now. Joe Platt, Hotpoint, described his company's continuous advertising of the kitchen planning theme and what this would mean in the future. George Miles, Jr., Westinghouse, told of the various "shadow boxing" programs his company had carried on to keep appliances serving now but to keep alive the market for tomorrow. Ross Vieths, Westinghouse Supply, cautioned against over optimism of markets and told how necessary it would be to train and promote for selling.

Alex Keuhlthau, Electromaster, told of his company's shift of distribution from utilities to dealers and distributors, and of its development of its commercial cooking line. J. I. Colwell, Graybar, echoed the sentiments expressed as to the need for active promotion. Steve Brundage, General Electric Co., presented Mrs. Elizabeth Madigan, home economist, Bridgeport, who spoke briefly about frozen foods and packaging and introduced the G-E color movie on frozen foods. This closed the compact and meaty two-day conference in a way to make all lick their chops, not only for the meat and strawberry shortcake with real whipped cream shown on the screen, but for the opportunity to go back into selling again.

● RAY GERNER has purchased and will operate San Diego's Radio City branch store at 2348 El Cajon Bldg. He had been a radio repairman with Bill Zimmerman of Radio City and before the war operated his own shop in Iowa. Recently released from the Army, he decided to go into business for himself again.

"There's a War On—"

The answer to this letter from a Captain in General Patton's army is "Don't you know, there's a war on," according to Mrs. Cleo N. Smith, of Smith Electric Co., Ogden. The letter in part follows:

"How is everything going along in Ogden? Has it changed much in the past four years since I first went on active duty? My, how times does fly in some ways and yet, on the other hand, it seems to me like an eternity since I called upon folks and visited with them.

"Say, on May 10, 1945, my wife and I will be celebrating (apart) our eighth wedding anniversary, and I would like to purchase something for her through a medium. And I'm stuck. I don't know what to buy her. Gifts over here in Germany are just out of the question; there isn't anything worth while, and besides, I'm not in a position to run down to a large department store and purchase whenever the notion strikes me.

"So I would appreciate it if you would purchase a gift—I am prepared to spend from $100 to $200, and I will rely upon your judgment.

"First, I would like to know, is the quality of goods at this time as good as they were prior to the war? Or are the manufacturing companies sacrificing quality for quantity?

"Now what can you suggest along the electrical line? Do you think it would pay to turn in, say our washing machine, upon a Bendix machine, or buy a good vacuum cleaner? Say, I just had a brainstorm. Do they still make those Sunbeam mixing sets?

"And how about those electric roasting sets, you know—where you can boil, fry, stew, bake, etc., in them? Perhaps that might make a nice gift.

"I'll tell you what, what would a good vacuum set, Sunbeam mixing set, an electric roasting set, all complete cost me?

"What I really want is to get something that both of us will enjoy in our latter life—that is, when I return home I would like to have all the comforts of home already provided for."

Mrs. Smith is answering the Captain's letter, sympathetic-like, but pointing out, "Sorry, Captain, but don't you know there's a war on?"

Radio Apprenticeship

San Diego's radio dealers and service repair technicians have taken steps to originate what may become the first radio apprenticeship training program in the State of California.

At a meeting held March 19 at the instigation of the Bureau of Radio and Electrical Appliances, San Diego radio industry members heard Vocational School Director Joseph G. Stephenson outline the state apprenticeship program. Under the plan, returning war veterans and others could train to be qualified radio technicians with both formal classroom work and practical experience as part-time employees in qualified radio shops.

The three-year course would commence with a three-month full-time class instruction, during which time the would-be-apprentice could decide whether or not he cared for the business. The remainder of the three-year course would consist of gradually decreasing class work and steadily increasing part-time employment in an approved radio shop capable of providing some measure of supervision over the student's work.

Stephenson explained that, under the G. I. "Bill of Rights," a returned serviceman would be able to receive governmental financial assistance.

Wages for apprentices will be set by the elected board and based on a percentage of the average radio journeyman's pay. Members of San Diego's radio industry elected to the apprentice board for the purpose of establishing the program and helping it to get under way are: Harvey Watt, A. D. Kilpatrick, Grayson Lovell, Al Reynolds, Harry Calloway, Ivan Lauritzen, and J. Clark Chamberlain.

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Five Years Behind

EVERYONE concerned with wiring and equipment installation is disappointed that the very necessary meeting of the Electrical Committee to revise the National Electrical Code, originally scheduled to be held this month, has been cancelled or postponed because of the ODT ruling on travel and meetings. For the Code is now five years old, has been chiseled and cut and altered by the urgent necessities of war, and when it was written there was little or no fluorescent or cold cathode lighting, welding, high-frequency equipment of various kinds, or a dozen other developments accelerated by the war.

What is causing most concern is that it takes a year or more to go through the democratic process by which the Code is revised. With the progress of the war at the beginning of the month, urgent need for a new Code may be felt much before that. Because the revision of the Code could not be classed as of immediate value to the war effort, no meeting was permitted. But it is to prepare for the opening of the flood gates of reconversion and returned civilian construction that the Code should be ready.

It is to be hoped that some way can be found before too long to call the Electrical Committee together and get this difficult task started. The industry at large is not content to let the emergency committee decide the many issues involved. That base is too narrow. Without complete satisfaction with the new Code it will not be widely adopted and a multitude of local codes spring up instead. If the slogan, "Let the Code decide" is to mean anything there must first be a new Code and quick—.

Hazards of U-V Lamps

ALONG with the wonders in bacteriological and mold control accomplished with ultraviolet germicidal lamps, there is one extremely serious hazard. Exposure to the rays of this lamp does not have to be very long before it constitutes overexposure. This results in serious burns to either the skin or the eyes or both. Not many cases of injury would be required to adversely affect the sale of this new equipment. And furthermore it is doubtful if the highly beneficial aspects of its application would offset the adverse reaction from such injuries.

Experience in the application of the lamp proves that it can be installed so as to prevent such injuries. The types of units now available for its use take these hazards into consideration and dangerous exposure can only come about if they were to be hung upside down. However, when the war is over there undoubtedly is going to be a large demand for these lamps and it is possible that there will be some unscrupulous promotion by people who see an opportunity for a quick profit. One possible approach to the problem would be to have Underwriters' Laboratories include in its standards a requirement that such a unit be equipped with a mercury switch which would prevent operation in case of improper installation.

The responsibility for advising and protecting the public, however, rests largely on the electrical industry. Every possible step should be taken to insure that those who will sell and install this equipment are cognizant of the hazards of faulty application and installation. Also no measures should be overlooked that will inform the public that the equipment can be dangerous unless properly installed. We repeat that the public benefits accruing from this lamp are too great to be jeopardized by failure to foresee and forestall obvious possibilities for misuse.

Don't Blame "the War"

PUBLIC lenience toward breakdowns in service from all kinds of business establishments and utilities occasioned by the war is going to disappear the day after V-day celebrations. Too many iniquities have been permitted to creep into customer procedures and customer relations in the name of "wartime conditions." Many of these stem from attitudes of mind or from breakdowns

in normal supervision and disciplinary methods.

Anyone who makes even the sketchiest survey will find that the public is expecting more than just a resumption of prewar service. To win and keep customers in the era ahead will require higher and higher standards of employee training. Ignorance and incompetence that have crept in during the war will not be tolerated in the future. Discourtesy and indifference heretofore excused because of wartime conditions will not be accepted. Everyone, including the employees themselves in all probability, will appreciate a return to prewar standards of service.

Personnel Engineering

IF plant equipment were no better engineered than the personnel of the average company is, it would go to pieces in no time. Were it not that the human being is tremendously elastic and adaptable and puts up with strains and maladjustments that no machine can, the so-called labor problem would long ago have exploded. That it is popping off in many places is not surprising, even if it is irritating.

This is because selection and training of personnel is *personal* rather than even remotely scientific in most cases. What is even sadder, any attempt to bring more scientific methods into personnel selection, advancement and training runs into very personal opinions and prerogatives of department heads and executives and stops there. None of the latter wish to give up the personal glory or prestige of hiring or advancing those under them. Few have the time to study or employ scientific testing methods, yet they do not allow others to use such means to help them.

Yet no sources of irritation in an organization are more resented than what employees look upon as favoritism, "pull" or boot-licking, suspected of having more weight than merit in the advancement of some fellow worker. It is when such conditions are *felt* to exist that they turn to a union for enforcement of what they feel is justice. Seniority "rights" and various union mechanisms bargained for in agreements are indictments of faulty and unscientific engineering techniques. Where satisfactory opportunities exist to advance in accordance with merit and not whim, no need for a pressure group exists either.

Management, if it is wise, will also see that where it has facts, tests and records to back it, it can save itself argument, ill will and wasted manpower, time and money by relinquishing much of its personal and often inaccurate prerogatives and relying on more careful engineering of this important phase of its business. It has turned to scientific engineering and accounting in these two phases of its business. Now it is time that the human phase receive just as intelligent treatment.

Salvage Paper

PAPER is a number one war material shortage —because over 700,000 different war items are wrapped, packaged, labelled, tagged or made from paper or container board. And the Pacific war, now that it is speeding up, will require stupendous amounts of paper and board since double and triple packing are required for protection against weather and insects. So we make these suggestions to each of our subscribers: Share this copy with friends. Unless copies are kept for binding, put this magazine into paper salvage. And look over your storeroom to get waste paper of any kind to put into paper salvage.

THE first rule of fair competition is that competitors play the game by the same set of rules. The basic rule of taxation is that all taxpayers of like nature shall be taxed uniformly. The nation's need for revenue to meet the tremendous cost of war and the constantly increasing expense of government dictates that no source of revenue be overlooked. Yet many lines of private business today are threatened with extinction and the nation is losing millions of dollars of desperately needed tax revenue because of tax exemptions and other special privileges and favors granted to rapidly growing groups of competitors. Carry the process to its logical conclusion and where would the federal and local treasuries secure the revenues to maintain the legitimate functions of government? There is only one answer. It would have to tax remaining taxpayers more heavily or begin taxing now privileged groups. If publicly owned power systems were taxed, the main argument now advanced to put private enterprise out of business would be ended . . . If tax exemption is not tax evasion, it is certainly a reprehensible and indefensible form of public begging. I say begging because any community or agency asking for tax exemption asks the rest of the taxpayers of the nation to make greater contributions so that it can benefit from a special privilege. This is the kind of rank discrimination prohibited by law in private business. We in the public utility business want no special privilege. All we ask is fair competition with all competitors abiding by the same set of rules and recognizing the same kind of yardstick. With such rules of fair play applied we would hold no fears for the future of private enterprise.—A. S. Cummins, president, California Oregon Power Company.

Back to the Farms Say the Engineers

More economical lines, expected load shifts, better operating occupy NWEL&P Engineering and Operating Section at Spokane

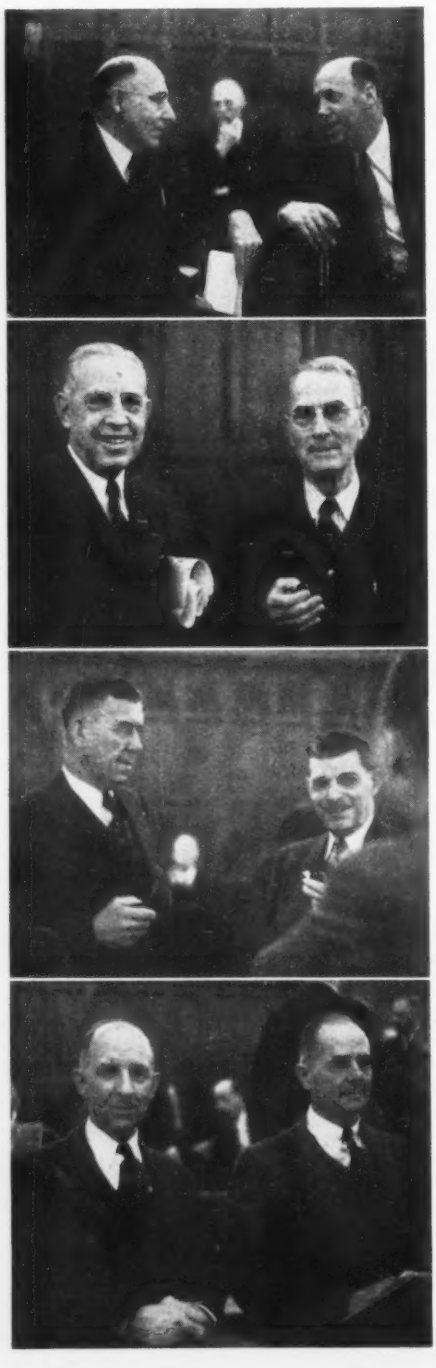
RURAL electrification, present and long-range planning for shifting and increasing loads and improved operating procedures were the major headings under which the Engineering and Operation Section of the Northwest Electric Light & Power Assn. discussed a multitude of detail at the annual section conference in Spokane, March 27 and 28. H. M. Jones, Idaho Power Co., chairman, and R. J. Davidson, Pacific Power & Light Co., vice-chairman, conducted the sessions which drew 60 electric utility men and manufacturers' and jobbers' representatives. It was explained that only 45 of these delegates came from outside the trading area of Spokane, and that, therefore, the conference was one which did not need special permission from the Wartime Committee on Conventions. All section meetings of the association since Pearl Harbor have been thus streamlined, since it was felt that large meetings were not appropriate during wartime.

In the rural electrification discussion led by T. A. Purton, Utah Power & Light Co., an aggressive resumption of rural line construction was seen, looking forward to eventual complete coverage of service territories on an area basis. Ways of lowering costs were sought, and among suggestions brought forward were increasing span length using high-strength conductors of steel or steel core aluminum, lighter poles, vertical mounting of circuits without arms, increased primary voltages, and more efficient construction methods. Some companies had found a saving in overhead costs from contracting rural line construction.

The caution was thrown out that revenue estimates on new lines had been low in the past, and that in some cases it had proved false economy to build light lines and then find it necessary, in a few years, to rebuild on account of increasing loads from added farm uses.

In the session on present and long-range planning conducted by O. L. LeFever, Northwestern Electric Co., the delegates told of attempting to forecast load growth, but admitted there was doubt as to how much of this was forecasting and how much was "groping". It was noted that considerable Army camp, shipyard, and other war industrial loads would be lost and that a return to normal habits of working daytimes and sleeping nights would change the character of load curves.

Left to right, from top: O. L. LeFever, Northwestern Electric; A. L. Pollard, Puget Sound Power, George Boring, G-E Supply; C. P. Osborne, PGE; T. A. Purton, Utah Power; E. H. Collins, Washington Water Power; R. J. Davidson, Pacific Power & Light; M. T. Crawford, Puget Sound Power & Light



Average estimates of load growth expected after the war fell somewhere between 5 and 7% annual increase compounded, meaning a doubling of load in from 10 to 15 years. Forecasting was being done in conjunction with sales departments, with the engineers attempting to gauge the effect of prospective growth on company systems. Among the factors involved in the revamping of systems to take care of load growths explored by the group were increasing distribution system voltages, increasing the load on existing apparatus, controlling water heating by carrier current, and installation of primary networks.

The situation with respect to poles for the immediate and long-range future was forecast by A. D. Decker, B. J. Carney & Co., Spokane. Chief reason for the present shortage centered around manpower problems, but a measure of relief could be expected after this year's production, Decker stated.

The prospect of using rural power lines for carrier telephone service to farms in cooperation with Bell telephone system was discussed briefly with the power companies indicating a willingness to cooperate in this development.

In a discussion led by H. H. Schoolfield, Pacific Power & Light Co., many ways of improving operating procedures were brought out. Improved tie-line control, telemetering, and better communication between systems by carrier current had been responsible for increasing efficiency in operating the Northwest power pool, according to M. L. Blair, the Washington Water Power Co. Installations of these equipments had not been completed by all pool members as yet, but were being completed as fast as apparatus was being made available.

Use for "walkie-talkie" radio communication between crews and members of crews strung out in construction and maintenance work was seen by E. L. Miller, Northwestern Electric Co., as a means of saving time on such jobs. Such equipment might also be used as an adjunct to present mobile radio sets used in dispatching and trouble shooting. In a discussion of

fire protection for transmission lines through brushy country, it was brought out that borax appeared to be a cheap and effective vegetation killer.

The wearing out of automotive equipment was proving a problem. There is a tendency toward standardization of make and model of line trucks and their equipment, with several companies using specially designed bodies. Pole digging and pole raising mechanical equipment mounted on trucks is finding more general acceptance and bulldozers are being used effectively for clearing rights of way and building roads along them.

The proposed revision of the National Electrical Code was highlighted by M. T. Crawford, Puget Sound Power & Light Co., and member of the electric light and power group of the Electrical Committee. The great need for revision this year to get caught up on the interim changes since the 1940 code was stressed.

Accident prevention standards were discussed, bringing out the need for protective devices for 11-kv. and 13-kv. lines, so that these lines need not be killed when linemen are required to climb up through them to reach transmission lines above. Non-breakable glass for eyeglasses was being promoted among its workers by Northwestern Electric Co., with the company paying one-half the cost of such glasses.

The growing use of electric welders on farms was seen as a potential trouble maker in the matter of voltage regulation on lightly loaded rural lines. Some companies had experienced a burning out of 3-kva. transformers from this operation.

Walter C. Smith, Pacific district engineer, General Electric Co., gave an illustrated talk on *Recent Developments in the Electrical Industry* at the Los Angeles EMEA dinner on April 18. He told of his findings during a recent trip to Schenectady, including data on new insulations, plastics, steels and silicones which will be available postwar. The G-E Melody Men quartet and the film, *Let Us See* were other program attractions.

RMEL Starts Redesign Plan

Wiring, appliances, lighting on first day of program; special utility problems on second

THE Rocky Mountain Electrical League's spring conference in Denver, April 19-20, under leadership of its new president, F. F. McCammon, and its new manager, Ralph B. Hubbard, emphasized (1) adequate wiring as a fundamental to successful all-industry performance and (2) the urgency for utilities management to put its house in order with planned policies to fit the postwar pattern.

J. E. Loiseau, president of Public Service Co. of Colorado, principal speaker at the April 19 all-industry luncheon, summed up RMEL objectives and responsibilities succinctly: "It's the end product that counts," identifying the ultimate consumer of electricity as possessor of the "end product" — a refrigerator, laundry equipment, lighting system or industrial machine. If the "end product" is good, credit is due to the collaborative efforts of all industry factors from beginning to end; if the "end product" is bad, the entire industry is at fault—and no buckpassing to the manufacturer, contractor, dealer, serviceman or utility company as the sacrificial goat.

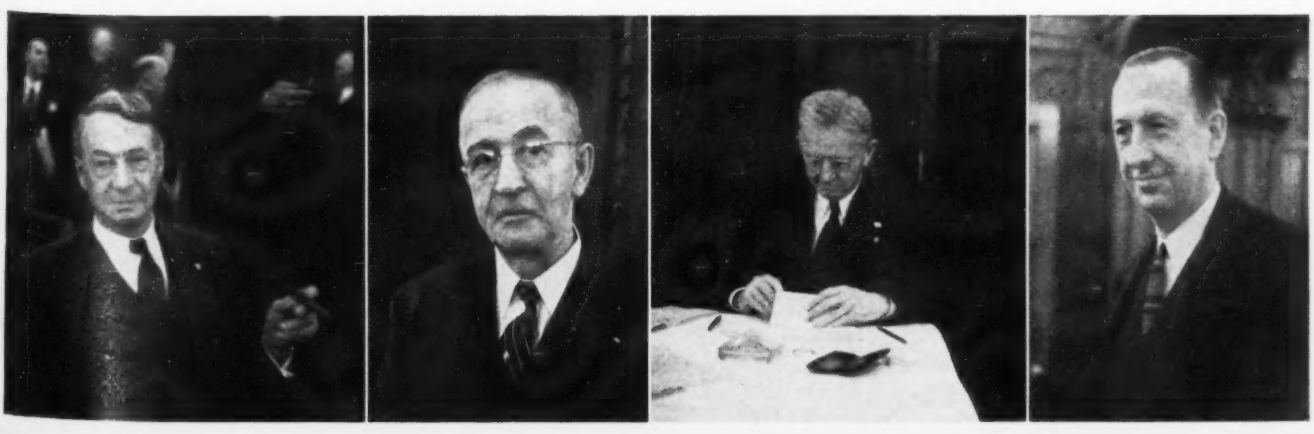
The first day of conference was dedicated to consideration of Adequate Wiring, Sales and Promotion, Manufacturers, Contractors, Retailers, Engineering and Accounting divisions' problems. The second day, utility managers concerned themselves with their specialized headaches, to the exclusion of all other business.

A remedy for much of the industry's difficulty was recommended by R. E. Johnson, Sturgeon Electric Co., Denver, who pointed out the need for additions of Architects and Electrical Inspectors sections to supplement present RMEL machinery. Such a set-up, he said, would incorporate adequacy and safety into construction from drawing board to physical completion of any structure. The present position of the electrical contractor, he stressed, is "behind the eight ball"—with competition forcing his bid down to the lowest possible figure, while demand is made for superlative power performance with safety factors right. The same situation prevails in reconstruction and rewiring designs.

Ray Jones, chairman of the Retailers Division, "viewed with alarm" the rumored installation by building contractors of all kitchen and laundry equipment as part of their postwar program and foresaw a diminishing dealer field of operations, rather than the bright prospect which should accompany the eventual lifting of the ban on materials which go into the manufacture of electrical accessories. He also took a gloomy view of tax-free merchandising cooperative competition, submitting facts and figures to bolster his thesis.

Harold T. Rankin, reporting for the Sales and Promotion Section, of which he is chairman, sounded a warning that lighting loads and merchandising prosperity will come only to those who cultivate them by alert promotion. He cited that the brownout in Denver "is being lifted slowly," despite the government restrictions being lifted on unnecessary lighting in the Rocky Mountain States, that some individuals and business establishments find they can "do without" and pro-

From left: H. H. Schoolfield, Pacific Power & Light; H. McCullough, owner, Tobacco River Power Co., Eureka, Mont.; Berkeley Snow, NWEL&P Assn. executive secretary; Cecil Kirk, Montana Power Company



pose to do so. He believes this condition may be an index to a postwar psychology applying, possibly, to merchandise and will need vigorous salesmanship to dispel the public's apathy. Rankin also warned that service staffs must make intensive study of new devices developed during the war, if the buying public is to accept permanently these improvements. "We must prepare for the improvements that will mean expert and advanced servicing," he said.

The utility managers, April 20, had no trouble agreeing that a "bottleneck" to first-class service existed in shortages of small transformers, meters, poles, hardware, crossarms, copper and manpower. They were further agreed that nothing could be done about it—much less run new lines in rural areas where load development would be subject to vigorous promotional activities. Definite plans were made to pool all information concerning labor union contracts and consolidate such knowledge in the light of WPB and other federal bureau regulations.

Probably the most urgent situation calling for solution in the Colorado region is a utilization of great power sources to be provided by completion, in 1946, of the Colorado-Big Thompson project. Present plans call for an all-out encouragement of industry into the area.

Strangely, the same problems that plague private utility management afflict communities in which municipally owned power plants operate. Membership in the league now includes executives representing seven municipals, with one of them on the RMEL executive committee.

Three Inspector Chapters Talk Code

Rocky Mountain, Utah and Montana IAEI groups review proposed changes and hear subjects pertinent to wiring safety in days to come

BIG issues have to be settled in small meetings these days. Wartime travel restrictions require that. Yet the issues for which the meetings are called need to be solved. For instance, the National Electrical Code is badly in need of revision. Five years have elapsed since its last revision. It was not considered entirely satisfactory even in 1940 at that revision, particularly as regards its wire tables.

The war has put great strain on the Code. So have new developments in lighting, electronics, infrared, machine tools, explosive substances and gases, and insulation for wire. These have outdistanced the Code. War necessity on the other hand has cut the Code down to an irreducible safety factor. Resumption of construction should not start ahead of a revised Code to fit modern practice and materials. For this reason a meeting of the Electrical Committee, NFPA, to revise the Code has been regarded as highly essential. But ODT has not given permission for the proposed meeting, May 14, in Chicago.

In lieu of the Electrical Committee meeting, it has been proposed that the Emergency Committee of the Electrical Committee meet and pass upon the proposed revisions officially submitted. To precheck the opinion from the field of practical inspection, meetings such as these held last month by the Rocky Mountain, Utah and Montana chapters of the International Association of Electrical Inspectors, declared Victor H. Tousley, field engineer, National Fire Protection Assn., secretary of IAEI and of the Electrical Committee, are especially valuable. A good proportion of each meeting was devoted to discussing with inspectors the proposed Code revisions and sounding out their opinions on controversial points.

The three meetings were held: April 6-7 at Denver, for the Rocky Mountain Chapter; April 10, at Salt Lake City, the Utah Chapter; and at Great Falls, April 13-14, the Montana Chapter. Outside speakers were few and those spoke on pertinent topics. There was no entertainment. These were compact, intensive technical and business meetings. Yet each had interesting differences, even on the same topics. The similarity was in the presentation of some of the more important Code changes, many of them controversial, for review and discussion and expression of opinion. This was done at each of the meetings by Victor Tousley.

Rocky Mountain Chapter

The Denver meeting, presided over by V. D. Markham, city electrical inspector, Colorado Springs, chairman of the chapter, began with a review of the past year's work by V. C. Moulton, chapter secretary-treasurer. Tribute was paid to the founder of the chapter, the late and beloved Lee A. Barley, who had been present at the last annual meeting. Beside the Code discussion, which will be covered later for all three meetings, the program was designed to give inspectors and industry members present a glimpse

Joe Wright, at left, explains electronics. Center: Chairman V. D. Markham talks to Leo Kelsey of Cheyenne. In background are Vic Moulton, James Mahan, Victor Tousley. Right: Next to Mahan is Ed Curran, then D. G. Mulligan, newly elected chairman, Harold Rankin, who took care of all arrangements, and Merriweather, at league luncheon

of things to come in electrical equipment.

Electronics was discussed by J. T. Wright, street lighting engineer, Public Service Co. of Colorado. He outlined the basic fundamentals, demonstrating with a cathode oscilloscope, and gave a simple explanation of how television works. Inspectors felt that such knowledge will become important and that the Code will have to recognize many factors involved in electronic applications.

John Ford, district manager, Electrical Products Consolidated, gave a thorough explanation of high-voltage lighting and pointed to its possible future applications. Because facilities to manufacture tubes in quantity are limited among sign manufacturers, he said that the field of packaged cold cathode lighting making by such companies as his own would be limited but that tailor-made jobs, with tubing to conform to architectural features, would be their field. Such jobs would always be high priced and not mass produced. He also discussed safety features undergoing improvement in transformer and terminal design.

Ben Farrah, Denver city electrical inspector, chairman of the Denver Code school, told of its operation and the resulting benefits received from it. George R. Hubbard, Boulder electrical inspector, spoke of electrical fires and accidents, urging all to report such to the IAEI in order that full data can be compiled and causes ascertained and eliminated.

Andy Riddle, manager of research, Colorado Fuel & Iron Co., addressed the evening session, predicting that new developments in electronics and other facilities would provide expansion and postwar jobs for the area.

Ralph Johnson, Sturgeon Electric Co., Denver, speaking on inadequate installation, said that the burden of providing adequacy was now placed on inspectors under the 1940 Code. He also explained the reason (reactance) for the 1940 wire tables, showing that this was something that should be reckoned in design of an installation. He urged that wiring be really designed, not left to the minimum of the Code and the pressure of inexperienced and unethical competitive contractors, which put the inspector on the spot to police adequacy.

Officers of the Utah chapter: Ray Powell, Harold Morr, chairman, C. E. Grant and D. J. Wolters, past chairman, now secretary-treasurer succeeding Grant

James S. Mahan, consultant, Chicago, and chairman of the IAEI membership committee, spoke on increasing membership and the coming importance of the inspector in postwar times. As representative for the Type-S fuse manufacturers he also discussed the availability of such fuses and the probable return in the Code of the mandatory requirement.

Lester B. Johnson, General Electric Co., Salt Lake City, exhibited the new slimline lamp and discussed both application and installation. He told of the prevailing thought in the development of fool-proof sockets and the hope that a standard will soon be established and approved by Underwriters. Also discussed was the voltage limitation for interior lighting. At the suggested limit of 600 volts, slimline lamps, taking a 700-volt starting current, could not be installed in homes where many applications would be desired.

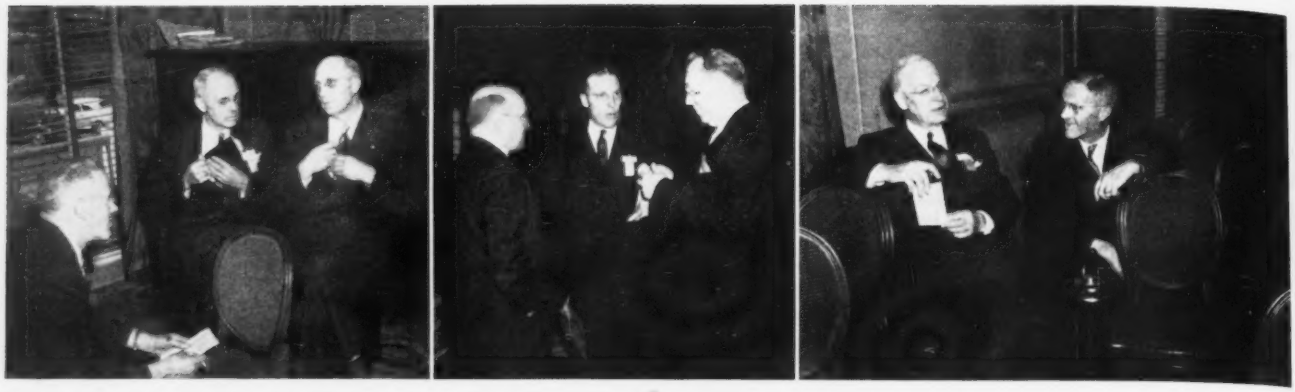
Officers elected for the chapter at the conclusion of the meeting were D. G. Mulligan, engineer, Mountain States Inspection Bureau, chairman; Leo Kelsey, Cheyenne city electrical inspector, first vice-chairman; Carl Simon, principal inspector, Area Engineers, Denver, second vice-chairman; V. C. Moulton, Mountain States Inspection Bureau, secretary-treasurer, and for the executive committee, past chairman V. D. Markham, Colorado Springs city inspector; George Hubbard, Boulder city inspector; T. P. Treadwell, fire chief, Fort Collins; E. P. Hodges, meter department, Public Service Co. of Colo.; Harvey Christenson, Rapid City, S. D., city electrical inspector; Austin Dunham, Anaconda Wire & Cable Co., Denver; Harold Vaughn, Denver; Tom Makey, IBEW, Colorado Springs; R. K. Foulk, meter department, Home Gas & Electric Co., Greeley; and Ralph Johnson, Sturgeon Electric, Denver.

Two Johnsons, Ralph and Les, at Denver

Utah Chapter

Compacted into a one-day session, the Utah Chapter meeting had less time for discussing the changes proposed for the Code. With a tight program and many speakers, messages of industry-wide interest were presented to the large attendance from the industry present at this meeting, both during the day and at the evening dinner sponsored by the Electrical League of Utah. D. J. Wolters, Salt Lake City chief electrical inspector, chairman of the chapter, presided at the day meetings, and Ora H. Barlow, president of the league at the dinner, turning over to J. A. Kahn, venerable General Electric Supply Co. manager, the toastmastership of the latter.

William L. Gaffney, Tacoma city inspector and secretary-treasurer of the Northwestern Section, IAEI, brought both a message from Harry Hilpert, Seattle state inspector, section president, and one of his own. After telling of the status of the section, he expressed for his membership disappointment and protest that the scheduled meeting of the Electrical Committee, NFPA, May 14, to revise the National Electrical Code, had been cancelled because of the wartime travel ban. Because of great changes in equipment, new materials and developments and also because the 1940 Code has become a "hodge-podge of amendments and addenda" in the five years since it was approved, cities, which depend upon the Code for the basis of their own ordinances, badly need a more up-to-date instrument. Nor was he in favor



At Salt Lake City: Left—W. L. Gaffney, H. G. Ufer and J. Hyde Stayner. Center—Maurice Dussenberry, A. E. Fleming and Kimball Vance, contractor. At right—Victor Tousley, secretary IAEI, Chicago; W. L. Gaffney, Tacoma

of a small group, the emergency committee of the Electrical Committee, passing on these changes without a more democratic representation from all the industry.

H. G. Ufer, Western superintendent, Underwriters' Laboratories, Inc., Los Angeles, cleared up distinctly the sometimes confused fields of work of the Board of Fire Underwriters and of Underwriters' Laboratories. Then he told how standards are set up and how to check whether equipment is listed for the specific application desired. Most criticism of Underwriters' labeled equipment, he said, when traced down, reveals wrong use or selection of equipment of improper rating.

Chairman Wolters commented on the recent passage of a sales control ordinance in Salt Lake City, announcing that lists of approved appliances would be maintained at his office for guidance of all local dealers in selection of approved equipment for sale.

To satisfy the growing interest in tubular cold cathode lighting, Tom Young, manager, Young Sign Co., told the history of neon signs and recent developments for interior lighting with improved fluorescent tubing. Salt Lake City area was fortunate, he said, that it had had no dimout or brownout for, in areas which had such restrictions, signs had deteriorated badly and become unsafe.

John Longden, branch manager, Westinghouse Electric Supply Co., turned his topic, *Jobbers' Problems*, into *Jobbers' Opportunities*, reviewing the many fields for expansion in electrification after the war. M. A. Strand, contractor, who was to have spoken, could not be present.

J. Hyde Stayner, past president of the section and chairman of the IAEI committee on "Elimination of Inadequate Wiring in the Postwar Period", Utah Power & Light Co., read the committee paper to the chapter. The paper received widespread commendation. Tousley told the group, and several requests have been made to reprint it and give it wide circulation. (It appeared in full as part 2 of the January 1945, News-Bulletin of IAEI.)

A. E. Fleming, senior electrical engineer, Headquarters, Ninth Service Command, Salt Lake City, gave an unusual report on a thorough study he has made of the hazards from possible static electric spark ignition the highly explosive anaesthetic gases in hospital operating rooms. He also told of means used to intercouple every piece of equipment and every person with a grounder grid to drain off such static electricity. Surprising statement he made was that a nurse walking across the operating room builds up a static potential of 1,000 volts. He also detailed other explosive hazards which must be rendered as safe as possible.

The remainder of the afternoon was devoted to a review of the proposed Code changes, given by Tousley. At the election of officers for the chapter, concluding the meeting, Harold S. Morr, Board of Fire Underwriters of the Pacific, was elected chairman; Ray Powell, superintendent, light and power, City of Nephi, first vice-chairman; C. F. Grant, Utah Power & Light Co., second vice-chairman (formerly secretary); and D. J. Wolters, the retiring chairman, secretary-treasurer.

First speaker on the evening program was Mayor Earl J. Glade of Salt Lake City, who paid high tribute to the electrical industry, commended the city inspector and his work, spoke enthusiastically of the new sales control ordinance just passed and urged its wholehearted support by all the industry. Victor Tousley also talked, outlining the need for Code revision and commending Stayner for the work of his committee on postwar wiring adequacy.

J. F. McAllister, Utah Power & Light residential sales manager, took a different approach to the adequate wiring story. All the big opportunities which are prophesied for postwar sales in electrical equipment, he said, will only become real if action is taken. Good times, he said, are not fixed as to immensity or time. They have to be made by action. Since the wire installed in a house is the supply line to serve what the industry wants to sell, action must be taken to make that sup-

Montana Chapter: Left—Secretary James Clune and acting chairman Ralph Grant. Center—Terry W. Hatveldt, Billings, and R. H. Jones, Montana Power. Right—H. K. Dickinson and Cecil Kirk, Montana Power, arrangements

ply line ample. He then told of many things being done now to prepare the bankers to lend enough money for adequate wiring and the builders to install it.

Walter Smith, General Electric Co., San Francisco, told of some of the remarkable developments during the war which will find postwar applications in many ways. His talk will later be published in full in ELECTRICAL WEST.

Montana Chapter

With a program having few speakers and thus more time for Code change discussion, the Montana Chapter held its Friday evening and Saturday all-day sessions in the kitchen auditorium of Montana Power Co., at Great Falls. Bruce Shavere, Lewistown REA inspector, chairman of the chapter was unable to be present and Ralph Grant, Havre city inspector and past chairman, presided over both day's sessions.

New officers of Montana chapter: Terry Hatveldt representing K. L. Chrysler of Billings, George Blend, chairman, Ralph Grant and James Clune, secretary

W. L. Gaffney, secretary, Northwestern Section, addressed the group much as he had the Utah Chapter, adding the admonition that everyone in the industry having anything to do with wire and wiring—contractors, journeymen, inspectors, wholesalers and utility engineers—should belong. He told of instances where knowledge gained in such meetings would have saved time, expense, prevented wrong usages and eliminated danger.

H. G. Ufer, Underwriters' Laboratories, likewise spoke along the same lines as he had in Salt Lake City, reported in the foregoing. James S. Mahan, Chicago, again spoke of Type-S fuses and of membership as he had at the Denver meeting. And W. A. Cyr, associate editor, ELECTRICAL WEST, provided this meeting, as he had both the Denver and Salt Lake dinner meetings, with comedy relief by exploding the "dream home" gadgets promised for the future.

Lester B. Johnson, General Electric Co., Salt Lake City, however, presented a new topic at Great Falls. He told of the uses, benefits and installation methods for both underfloor duct and for the cellular steel or Q-floor, which provides such ample facilities for running and changing electrical circuits in a building. This he illustrated by lantern slides.

At the conclusion of the Montana meeting, the officers for the ensuing year were elected. They are: George Blend, electrical inspector, Army Air Base, Great Falls, chairman; K. L. Chrysler, city engineer, Billings, vice-chairman; Ralph Grant, Havre city inspector, second vice-chairman; and James Clune, Chinook Electric Co., Chinook, Mont., secretary-treasurer.

Code Changes

The only chance there will be to discuss the Code changes being proposed, preprinted in the IAEI News-Bulletin as part 2 of the March 1945 issue, said Tousley, will be at chapter meetings. If the Electrical Committee can meet it will do so before any section meetings and there is doubt that any section meetings can be held at all. Therefore, he submitted many of the more important changes to the opinions of these chapters in order to ascertain the acceptability of them to the industry.

Among the more important or radical Code changes discussed were the following:

Article 210—Branch Circuits. Practically rewritten. Color code eliminated. Common neutral back in (this was protested again as being impractical to inspect). "Continuous load" out. Show window lighting on either 200 watt per lineal foot or 1½ amp. per outlet. Range feeders can use smaller neutral. (This was protested if the neutral should be any smaller than No. 8.) Type-S fuses to be mandatory.

Article 300—Entirely new with a new article 310 which proposes the elimination of sizes 8 and 10 and substitution of sizes 7 and 9, with current carrying capacities of 45 and 30 amp. respectively to better fit switch and fuse ratings. Also elimination of many types of wire insulation and standardization on type R and RH for larger sizes, with better heat resistance and carrying capacities to fit former practice in 1937 Code tables. Insulation on No. 14 wire cut to 3/64 in. to reduce conduit cross-section fill. Removal of the 50% fill permission in existing buildings.

Article 370—Outlet Boxes. New portions in 373.

Article 410—Combines 410 and 420, rewritten and not fully approved but submitted for consideration. Covers terminals for fluorescent — both hot and cold cathode or high voltage, and requires automatic disconnect of live parts upon removal of tubes or lamps or on opening of enclosures. Also limits voltage in dwelling occupancies to 600 volts. (This was questioned because under it the new long thin lamps which start on 700 volts would be banned from residential use.)

Article 450—Transformers. Rewritten, especially the section on autotransformers.

Article 500 — Hazardous Locations. Rewritten in extreme detail, with several classes within classes. (Felt by all groups to be too complex and involved for practical inspection.)

Article 600—Signs. Revised.

Article 630—Welding. New and important.

Two other items were also discussed. In Article 250, the new proposals would require multiple grounding of systems feeding stock barns because of numerous deaths of cattle, where shorted milking machines, due to length of run to ground, have failed to open fuses and made all contacting metal alive. This multiple grounding is being protested by the IBEW as violation of basic safety principle but Tousley said that reality forced a conclusion that such grounding procedure in this case was a necessity.

The other point was that use of a short cord and plug receptacle from a fluorescent fixture to an outlet would be prohibited by the rewritten paragraph 4125. This would prevent quick replacement of the entire fixture in industrial plants as a quick means of maintaining lighting units over industrial operations.

As Lester Johnson commented to the Utah Chapter at the close of Tousley's discussion of Code changes, the preprint of these changes should provide chapter meetings with food for discussion for many a meeting and the opinions derived from such discussions should be relayed back to the Electrical Committee to aid it to fashion a more practical and more perfect National Electrical Code.

NEWS of the industry

REA TAX REDUCTION ARGUED IN COLORADO

The hottest potato in Colorado's legislative hopper turned out to be House Bill 697, sponsored by five representatives whose rancher-farmer backgrounds placed them in full accord with REA objectives.

The measure was known as the REA Tax Bill and was drawn to provide assessments by the State Tax Commission on a basis of 50% of annual gross revenues. Amendment in the House boosted the tax base to 100% of gross annual revenues, which would reduce to about 25% of taxes paid by private utilities the amount levied against Colorado REA affiliates. No organized resistance was apparent and the bill, under powerful co-op benediction, passed the House. The state senate got it nearly ten days before the assembly's April 6 adjournment, and it went to the corporations committee for processing; it was still there April 2, twenty-four hours before the deadline established for consideration of bills on third reading.

Senator A. H. Twining (Dem.) made formal demand that the REA bill be reported out of committee, warning that he would put the issue to a test vote the following day if nothing happened. He was as good as his word. During debate on Senator Twining's motion to blast the bill out of committee, party lines were ruptured and bitter invectives were hurled. The storm, however, did not break until after Senator Robert G. Bosworth (Rep.), chairman of the corporation committee, gave a well-considered report:

H. B. 697, he said, offered no justification for a reduction in REA tax rates; its passage would be a detriment, rather than advantage to the areas affected, since county, school and road revenues would be impaired through loss of taxes; the act was vague and inconsistent; provided no sound method to determine where a distribution system begins or ends; offered no claim that poles, wires, insulators or lines serving REA consumers are different or cost more than those used by private electric utilities; frankly admitted that the purpose of the act was to tax rural electric associations on a different basis than that used in taxing private utilities. "The committee feels," Senator Bosworth concluded, "that the bill is unconstitutional, since the law provides that all taxes shall be uniform on the same class of subjects."

Promptly, Senator Averill Johnson (Dem.), supporting Twining, asserted, "Private utilities have failed in their duty to rural communities," and that, because the electric cooperatives sought to remedy this failure, they were entitled to tax relief. His democratic colleague, Senator Curtis Ritchie, responded with heat: "Farmers are already more subsidized than any other group." From the Republican side rose Senator Arthur Laws with the declaration that the bill was "vicious and calculated to develop the greatest holding corporation the world has ever seen." Senator Charles Murphy (Rep.) called Laws a liar and was, in turn, named. No blows were struck due, probably, to the diplomatic efforts of the sergeant-at-arms.

The vote, finally taken, was 17 for and 16 against consideration of H.B. 697. It died for the duration of the assembly only.

Statehouse rumors predict that the REA tax bill will be a political issue at the next election.

Army, Navy Step In to Avert IBEW Strike

Strike of nearly 4,000 AFL electrical workers on the Pacific Gas and Electric Co. system was halted temporarily last month, following intervention by the Army and Navy. Failing settlement of a wage dispute before the Regional War Labor Board, (EWEST April, p. 103) the union had scheduled a walkout in nine company divisions on April 19, but agreed to a 30-day truce.

Gene L. Green, WLB disputes director in San Francisco, had warned IBEW officials of the "irreparable and adverse effect" a strike would have upon war production and had pointed out that the walkout would come during the United Nations Peace Conference, causing embarrassment to the government.

The dispute went to WLB last fall and union members reportedly have objected to delays in settlement. The board has stated that the union itself forced delays by injecting new issues and holding up brief filings.

● As a TRIBUTE to the late President Roosevelt, Interior Secretary Harold L. Ickes has named the 151-mile lake formed by Grand Coulee Dam "Franklin D. Roosevelt Lake." The lake stretches from north central Washington to a point just across the Canadian border.

USBR PLANS POSTWAR PLANT EXPANSION

Generating capacity of existing or proposed hydroelectric plants owned or operated by the Interior Department's Reclamation Bureau in 17 Western states would be quadrupled to 9,324,000 kw. under a postwar program prepared by the bureau, involving 415 projects estimated to cost $4,792,000,000 at 1940 price levels.

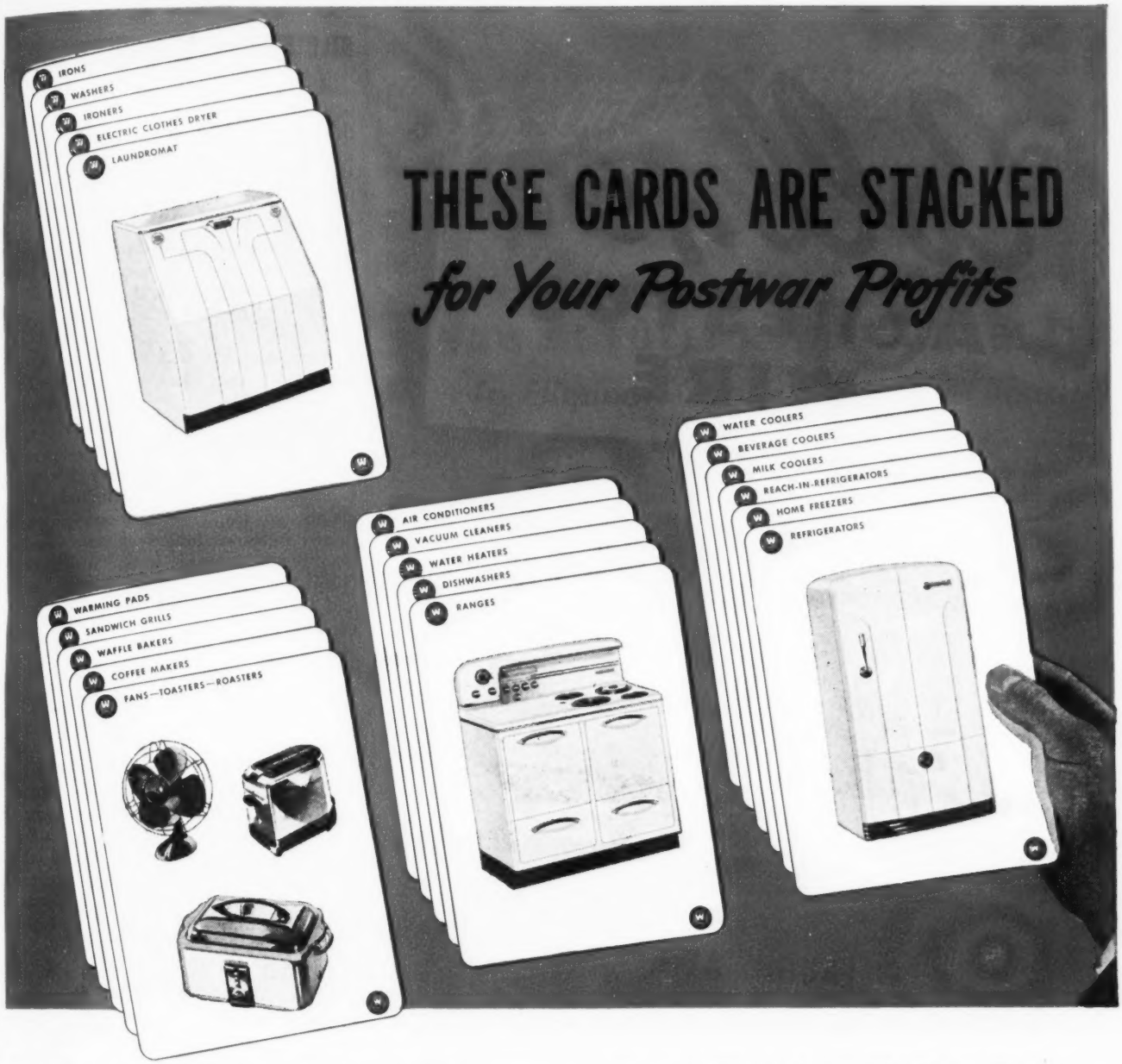
Existing reclamation power plants, totaling 2,440,000 kw., would be increased to 5,052,000 kw. by installations of additional units. An additional 4,271,720 kw. would be installed in plants now under study, Commissioner Harry W. Bashore told the House Irrigation and Reclamation Committee as it conducted hearings on a bill aimed at making reclamation farms available to war veterans.

The 415 proposed "inventory" projects include 21 authorized plants and 51 new power stations under study. New power stations would be installed in Arizona, California, Idaho, Montana, Nebraska, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington and Wyoming. Already authorized plants would be installed in all these and Texas and North Dakota as well. Plants range in size from a 600-kw. station in South Dakota to the proposed 750,000-kw. plant at the Kanab Creek site in Arizona.

Capacity under study for the Far Western states but not yet authorized is as follows: Arizona, 1,877,200 kw. in five plants; California, 627,400 kw. in eleven plants; Colorado, 574,000 kw. in four plants; Idaho, 138,620 kw. in five plants; Montana, 31,400 kw. in two plants; Nevada, 16,000 kw. in two plants; New Mexico, 102,400 kw. in four plants; Oregon, 7,800 kw. in two plants; Utah, 124,700 kw. in four plants; Washington, 622,000 kw. in one plant; and Wyoming, 75,000 kw. in eight plants.

Testifying for the same bill, Interior Secretary Ickes told the committee that Reclamation had progressed from early projects which were small and often unrelated to a point at which "within a few months, the Bureau of Reclamation will have complete reports on the coordinated development of 15 river basins throughout the West."

● To REPLACE two worn-out generators at its Swan Falls power plant, Idaho Power Co. is installing two new 850-kw. machines. Work is scheduled for completion this spring.



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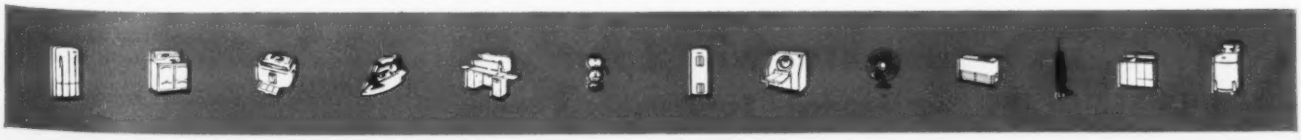

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NEW COLUMBIA AUTHORITY BILL BEFORE CONGRESS

A new regional authority bill, creating a Columbia Valley Cooperative Authority, was laid before Congress last month by Representative Walt Horan, Washington Republican. In large part, the Horan bill is based on the TVA act, although it differs radically in many respects, particularly in its provision for payments in lieu of taxes.

The authority would be controlled by five directors appointed by the President for seven-year terms at an annual salary of $15,000. Four directors would be recommended by the governors of Idaho, Montana, Washington and Oregon.

Created with the board of directors would be a Columbia Valley Advisory Council, its members to include governors of the four previously mentioned states, members of state Columbia Basin commissions, which the Horan bill asks the states to organize, and the Director of Conservation and Development of Wyoming. No development proposal could be sent to the President or Congress until submitted to the advisory council for its views.

The bill removes the Bonneville Power Administration from jurisdiction of the Interior Department and substitutes a measure of home rule for Washington rule. As soon as the authority was operating, it would take over the Bonneville Dam and transmission system and all property, personnel and funds and the Bonneville project act would be repealed.

The bill directs the authority to formulate and present to the President and Congress as soon as possible "proposals for carrying out the purposes" of the act, power development and utilization. They would become effective if not affirmatively disapproved by Congress within four legislative months after their submission.

The authority would be bound to recognize existing water rights and laws, and would be required to recognize the doctrine of the beneficial consumptive use of water, making water available, in case of dispute, for domestic, irrigation, mining, industrial, flood control, navigation and power development purposes in that order. Power and water projects would have to be "collectively self-supporting and self-liquidating."

The authority could build, acquire and operate those things it found to be necessary or appropriate and could acquire property by purchase, lease, condemnation or donation. It could not acquire the electric properties of any state political subdivision which opposed such acquisition except in specifically stated cases. It would be authorized to produce, transmit and sell electric power and engage in other activities. It could enter into such contracts and agreements and do such things as might be necessary or appropriate.

In its power business, the authority would

have to give priority to public and cooperative purchasers and assist them in acquiring distribution systems. It could stipulate resale provisions in wholesale power contracts and would be required to publish rate schedules "necessary or appropriate to provide adequate markets and outlets for electric energy and to encourage the widest possible use of electric energy." Rate schedules "shall have regard . . . to the recovery of the costs of generating and transmitting such electric energy, including appropriate reserves for maintenance and upkeep . . ." and for amortization.

Net profits, after operating costs, financing costs and a contingency fund not to exceed 10% per year, would go into the U. S. Treasury.

The authority would be authorized to issue revenue bonds all charges of which would be payable only from authority revenues and which would not be guaranteed by the U. S. Necessary appropriations by Congress are authorized.

The authority would be required to make payments in lieu of real or personal property taxes on any electric system or other acquired property, to make payments in lieu of business, franchise and other similar state and local taxes allocable to any electric distribution or related facilities acquired and operated by it, and to make payments in lieu of taxes whenever it found that the tax revenues of any state, county, district or other taxing unit "have been substantially affected by acquisition of real or personal property or any interest therein . . ." This latter requirement would apply only when such tax loss had not been offset "by gains derived by that (taxing) unit from the operations of the corporation . . ." These payments in lieu of taxes would be equal to the average amount of taxes paid on the property concerned during the last three years it was privately owned before it was acquired by the authority.

Survey May Bring Larger Utility Franchise Tax

To determine how much electric current metered to private homes in California is used for "power" as distinct from lighting purposes, the League of California Cities plans a state-wide investigation which may result in a larger utility franchise tax return to cities.

Utilities producing electric current now pay as franchise tax to municipalities 2% of gross receipts from "power" sold. None of the current going to private homes is taxable since it is classified as "light" current, the League pointed out.

● REA CONSTRUCTION contract awards announced recently include: A $16,976 contract by Yellowstone Valley Electric Cooperative, Huntley, Mont. to D. M. Manning, Hysham, Mont., for construction of 18 miles of line to serve 38 members. The State Water Conservation Board is engineer. Benton-Lincoln Electric Cooperative, Corvallis, Ore., has let a $56,053 contract to the City Electric Co., Boise, Ida., for construction of 49 miles of line to serve 111 members. T. C. Smith is engineer.

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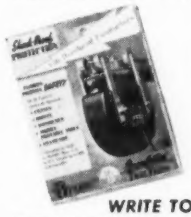

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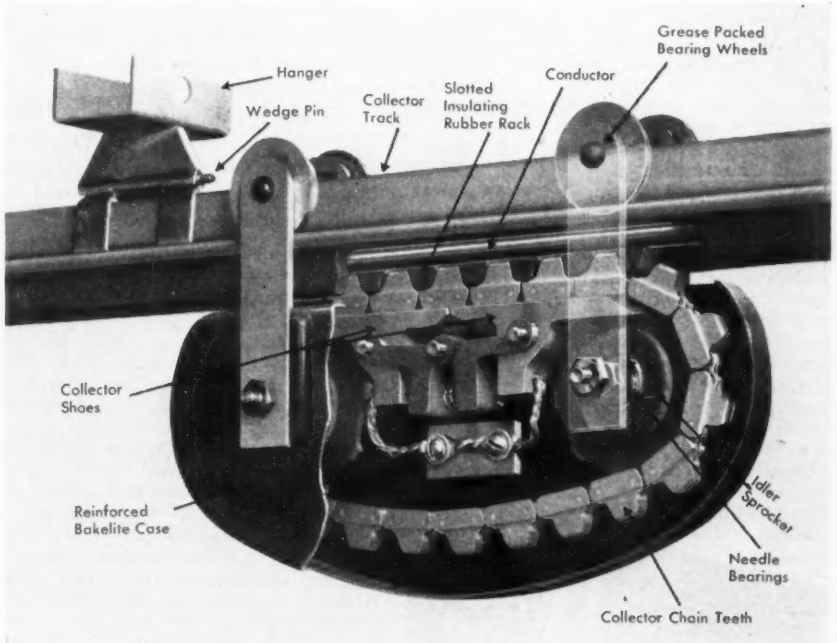

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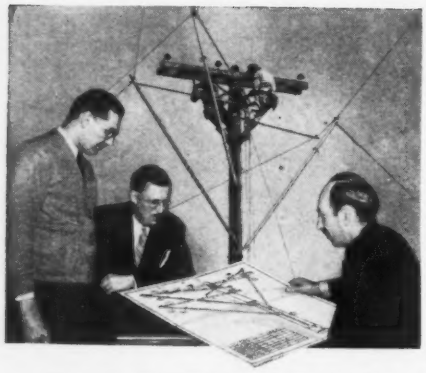

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FORT PECK POWER RATE CONFIRMED BY FPC

Contract between the Bureau of Reclamation and Montana-Dakota Utilities Co. for sale of Fort Peck power to the power company has been approved by FPC, which at the same time confirmed USBR rate schedules. The contract is to run for 15 years.

Under terms of the contract, power company lines will be used to transmit power from Fort Peck to irrigation and REA projects in the Yellowstone and Missouri River valleys, and the company will turn over to Reclamation all present contracts with irrigation projects. A 2.5-mill rate for pumping power during irrigation season has been established.

The company will get an undisclosed amount of power for distribution to its own customers and has agreed to pass on to these customers in rate reductions any savings realized by purchase of energy from the federal project.

Delivery of the power will be made at the government's Glendive, Mont., substation. A 140-mile, 110-kv. line from Fort Peck to Glendive, is nearing completion and will go into operation late this summer. Power will be transmitted by the company from Glendive to eastern Montana and western North Dakota points between Wolf Point and Forsyth, Mont., and Stanley and Hettinger, N. D.

Ultimate capacity at Fort Peck is 105,000 kw. One 35,000-kw. generating unit is in operation now and a second unit of 15,000 kw. will be installed in the near future. The contract with the power company calls for one rate schedule until the second unit is installed and a second schedule after.

Monthly rate for power during the first period: Demand charge, $0.75 per kw. of firm power; energy charge, 3.5 mills per kwh. for the first 250 kwh. of firm power and 3 mills per kwh. for all additional; minimum bill $1 per kw. of actual maximum demand but not less than $1 per kw. of the firm power then in effect. A 5% discount is allowed on the demand and energy charges when delivery is at 33 kv. or higher.

During the second period the monthly power rate will be: Demand charge, $0.75 per kw. of 30-minute integrated maximum demand as defined in the contract; energy charge of 3.5 mills per kwh. for the first 250 hours use of the maximum rate of delivery and 3 mills per kwh. for all additional.

Firm power is to be available to wholesale power customers of the United States for light and power service supplied through one meter at one point of delivery. Monthly rate: Demand charge, $0.75 per kw. of billing demand; energy charge, 0.35c per kwh. for the first 250 kwh. of billing demand, 0.30c per kwh. for all additional. Minimum monthly bill, $1 per kw. of contract demand and a 5% discount on demand and energy charges is provided, if delivery is made at transmission voltage of 33 kv. or higher.

Dump power rate is 2.5 mills per kwh. Commercial service is to be available in Fort Peck, Mont., at 2c per kwh.

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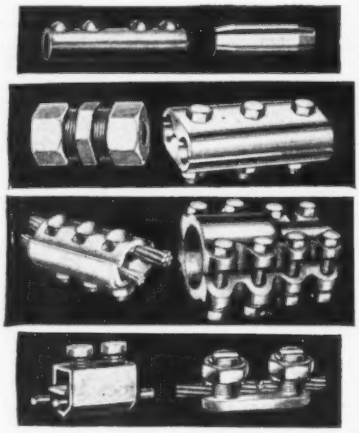

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WASHINGTON HIGH COURT UPHOLDS PUD BOND ISSUE

In a six to three decision given April 9, the Washington State Supreme Court upheld Okanogan County PUD in its proposal to issue $2,702,000 in revenue bonds to purchase properties of Washington Water Power Co. within the district. The court affirmed a Whatcom County court decision of last January, which dismissed an action brought by the power company and other Okanogan County taxpayers to enjoin the PUD from issuing bonds in excess of the $2,227,531 valuation placed on the property during condemnation proceedings.

Effect of the decision, which was written by Justice A. Robinson, was to rule that, after judgment of award has been made and entered, a PUD cannot be enjoined from issuing bonds, or using the proceeds of bonds issued, in excess of the amounts authorized by district resolution upon which the condemnation suit was commenced.

A motion made by the power company to strike from the opinion a provision immediately completing the purchase, was continued by the state court for a week. The company was said to be considering appeal to the U. S. Supreme Court.

PUD Starts Condemnation Suit in Stevens County

Stevens County (Wash.) PUD last month filed condemnation proceedings against Washington Water Power Co. properties in the county. The PUD commission previously had voted to issue $2,000,000 worth of revenue bonds in $1,000 denomination and had named W. S. McCrea, Jr., of Tacoma as engineer and Thomas I. Oakshott of Colville as attorney.

Power company customers in the area include the town of Colville, with population of about 2,400, the town of Chewelah, 1,500 population, a wholesale customer; Spokane-Portland Cement Co. and magnesite operations.

Properties which would be condemned include the Chenelah transmission line, two 33,000-volt lines extending north to Colville, Palmer and Evans, and a small hydroelectric plant at Myers Falls.

● Pacific Gas and Electric Co. will construct a 60-kv. primary transmission line in the Challenge area of Butte County, Calif., at a cost of $100,000 to serve lumber mills, it was announced recently. The line will extend from Bullards Bar to the Challenge substation, where eight miles of 11-kv. line will connect with the mills.

CLARK COUNTY PUD ASKS VALUATION HEARINGS

Condemnation proceedings against Clark County, Wash., properties of Northwestern Electric and Pacific Power & Light company properties were filed in Vancouver superior court last month by the Clark County PUD. Similar proceedings against Portland General Electric Co. were started last February. (E. WEST, March, p. 94.)

Since Pacific company is not a Washington corporation the company's petition for removal of the case from state to federal court was granted. The case will be heard in the U. S. District Court at Tacoma.

In the petition for a valuation hearing, PUD Manager George Hibbert stated that the district would not accept either the Northwestern or Pacific properties alone, since they are operated now by Northwestern as an integrated system.

Pointing out that the people of Clark County never have had the opportunity of voting on PUD acquisition of the properties, T. E. Roach, vice-president and general manager of Northwestern Electric, recalled that a strong vote was recorded in the county last fall against a public power measure on the state ballot and that PUD commissioners favoring condemnation were defeated for re-election at the same election.

Sacramento District Files Appeal for Possession

Sacramento Utility District last month took to the California Superior Court its fight for possession of Pacific Gas and Electric Co. properties within its boundaries. In its appeal, the district asked for appointment of a receiver to supervise and coordinate severence procedure.

A condemnation judgment was awarded the utility district last January and an appeal by PG and E is pending in district court. (EWEST, April, p. 110).

Spokesmen for the district stated that, if possession is granted at the hearing, it is prepared to deposit with the court the entire purchase and severance price of $11,632,000. The company, which contends that the valuation is too low, said that it would continue its appeal.

● OFFICIALS of Bonneville Power Administration announced last week that construction will start May 1 on the Eugene-Drain power line and that the line will be completed within 90 days. About 400 new customers in southern Lane and northern Douglas counties will be served by the new line.

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LIGHT METALS INDUSTRY VITAL, RAVER STATES

Continued full-scale operation of Pacific Northwest aluminum plants was urged by Bonneville Power Administrator Paul J. Raver last month, in commenting on the apparent lack of local understanding of the importance of bringing the Troutdale, Ore., plant up to full capacity. The light metal industry is of vital importance not only to the war effort but to the entire economic structure of the Pacific Coast, he stated, and warned that failure to supply manpower for two idle potlines at Troutdale would affect negotiations for development of other industries requiring manpower.

In March Raver had told the Senate's Small Business Committee that about half of Bonneville's revenues come from aluminum load and that disposition of federally owned reduction plants in the Pacific Northwest would have a serious effect on the power program. He emphasized the necessity for inducing new operators to enter the aluminum field and pointed out that this could be achieved by careful drafting of the government's plans for disposing of existing federal plants.

He stated that the government had destroyed some of the value of its aluminum holdings by financing the Shipshaw development on the Saguenay River in Canada, where, he said, aluminum can be produced to undersell U. S. metal in world markets because the plant has been paid for by U. S. funds.

Low Interest Rate Secured On Los Angeles Bond Issue

Interest rate of less than one per cent on $9,650,000 of electric plant refunding revenue bonds was obtained in mid-April by the Los Angeles Department of Water & Power from Glore, Forgan & Co. & Associates, of New York. Lowest interest rate in the department's history, the successful bid was lowest of four submitted, and ranging from 0.9372 to 0.9841%.

Proceeds of the new issue will be applied to retirement of $7,940,000 of 1940 and $1,920,000 of 1941 refunding power bonds, bearing interest at 1½ and 2%. Securities of the old issues would have matured from 1949 to 1959, while the new issues will comprise maturities starting April 1, 1946, to April 1, 1959. The refunding will result in a reduction in debt service to the department of $835,000, of which $668,000 will be accounted for by lower interest cost and about $167,000 by the shorter life of the issue, it was reported.

SUSTAINED CONSTRUCTION ACTIVITY

One Step Toward High Level Employment

IN the 34th editorial of this series, it was pointed out that sustained prosperity, based on high level employment, was a major postwar goal accepted by government, management and labor.

That editorial developed the theme that, if the goal were to be approached without undue sacrifice of our essential liberties, we must forego the search for magic panaceas, and follow the harder but more promising course of analyzing step by step, and industry by industry, the measures that might contribute toward the end sought.

This is the first of a number of editorials following such a particularized approach. It will examine the role of the construction industry in forwarding sustained prosperity.

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The influence of construction upon the general level of economic activity is important but not decisive. The claim is frequently advanced that major fluctuations of the business cycle might be ironed out by a properly devised and timed public works program; but any examination of the relatively modest contribution of construction activities to total national output will demonstrate its extravagance.

In the twenty years from 1920 through 1939, the value of new construction averaged just over 8½% of the gross national product. If we add repair and maintenance expenditures, the total is increased to a little over 12% of the gross product. But approximately two thirds of the construction of this period was privately initiated, and only one third was represented by government construction, federal, state and local combined. To expect that we can level out the peaks and valleys of our whole economy through manipulating the 4% portion that is represented by government construction is to expect a very small tail to wag a very large dog.

In fact, the record of construction activity in the past has been on the side of disequilibrium rather than stabilization. In boom times construction activity has climbed to relatively higher peaks than those reached by the economy as a whole; in depression periods it has fallen to deeper troughs. Aside from the special work relief program of the depression thirties, the performance of public construction in this respect is little better than that of private. New government construction mounted with the general trend of the boom from 1921 to 1929, thereby adding its weight to the inflationary trend.

Instead, then, of expecting the construction industry to stabilize our whole economy—a task clearly beyond its power—it would seem appropriate to ask that it look to the more attainable goal of leveling out its own violent fluctuations. If this can be done, many of the most vexing problems of the construction field and of its sphere of influence will be mitigated, employment will be regularized in one important segment of industry where the past record has been particularly uneven, and one aggravating contribution to general business instability will be removed.

The achievement of these highly important, if limited, aims will require the thoughtful, vigorous, and concerted cooperation of management and labor in the construction industry, of a variety of governmental agencies, and of those who direct the sources of construction credit. Of the many measures that must be woven into an ordered program, it is practicable here to present only the broad outline of those which seem to offer the greatest potential usefulness.

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1. Stabilization implies the holding of a balance rather than a freezing at a given level. No rigid formula for a most desirable level of construction activity is possible or desirable. However, it may be accepted as a reasonable initial premise, that we could sustain in the future without major distortion something like the 12% ratio of total construction to gross national product that has been approximated in the past. If it is to serve as an useful reference point, such a generalized premise must be subjected to constant testing both nationally and locally. There must be careful and continuous scrutiny for signs of demand saturation, cost inflation, and labor shortages, all danger signals of far greater reliability than any percentage formula.

The first requisite then is the general availability of information along such lines, far more complete and current than has hitherto been at hand. The second is a general will to hold building activity at a level as high as but not higher than we probably can sustain. Once this principle is accepted, the problem becomes one of marshalling all available instrumentalities to forward it.

2. Public construction, although too small to exert a decisive influence upon economic activity as a whole, can

condition construction trends to a major degree. If, in the decade following the war, government construction approximates its 1920 to 1940 average of one third of all construction, its properly timed impact could do much to level out the construction cycle.

To do this most effectively, public construction should be deferred where and when private building is going forward at a satisfactory pace, and should be started when and where private activity shows undue slack. All government construction does not lend itself to such adjustment. But a large portion of it could be held up for the three to five years which, upon past experience, would provide the necessary leeway to counteract the more violent fluctuations in private building.

Such a program presents numerous difficulties both political and administrative. None should be insurmountable, and the results promise to be of sufficient moment to justify the extraordinary effort that would be required to coordinate federal, state and local government programs. Here is an excellent forum for testing whether or not government economic activity can be made to supplement rather than supplant private effort to serve ends upon which all are agreed.

3. Since private building, postwar as in the past, must supply the preponderant share of construction activity and employment, costs will continue to play a dominant role in determining levels of operation. Wartime restrictions have created formidable backlogs of deferred demand for most types of private, and for many of public, construction. Such demand is so great that it almost certainly will provide the impetus for a postwar building boom of several years duration. There is considerable doubt that in the beginning our building trades, dislocated by war and at low ebb, can organize rapidly enough to carry their share of the anticipated general advance.

However, if former patterns hold, building activity, after a lagging start, will soar, costs will mount, and eventually will saturate effective demand with resultant collapse. That, of course, is precisely the sort of a situation we are seeking to avoid. Crucial to this end is the prevention of rising costs or, better still, the reduction of building costs from present swollen levels.

A recent study by technicians of the War Production Board on the outlook for private housing construction illustrates the point. From 1900 to 1940 the number of housing units built in this country closely matched the statistics of new family formation. The former ran considerably ahead of the latter from 1920 to 1929, and fell behind by the same margin in the following decade.

If the market for new houses were to be similarly limited for the period from 1940 through 1949, the effective demand for new housing during the last five years (1945-1949) is estimated at 3,000,000 units. That is after allowing for houses built from 1940 through 1944, and for vacancies, demolitions, and other factors. If, however, prices could be reduced to 1939 levels, the 3,000,000 unit demand is estimated as increasing to more than 7,000,000 units. Since the latter figure is substantially beyond our production capacity for the period, a backlog would be created that would support an effective sustained demand for the subsequent decade (1950-1959) of 1,000,000 units per year, as against half that amount if rents and sales prices mount with increasing incomes.

The precise accuracy of such an estimate may well be questioned. There can be no question as to the general validity of the point illustrated. The progressive lowering of construction costs will stimulate demand in this field as it has in others. Building management, labor, and their suppliers and customers stand to gain from such a result. Unnecessary restrictions against the adoption of improved technologies and increased productivity should, therefore, be removed, whether imposed by codes of government, regulations of unions, collusion of managements, or inertia of workers. Unless there are compelling social justifications such restrictions must be judged harmful to the whole economy.

4. Numerous other measures could contribute substantially to increased and increasingly stable construction activities. Space remains only to stress the importance of careful consideration for the use of credit facilities as a means of stabilization. In recent years the establishment of the Federal Housing Administration provided a needed stimulus to mortgage lending in the field of housing. The modern pattern of long-term mortgages, providing for regular amortization as well as interest, should be a steadying factor in periods of liquidation. However, there appear to be further possibilities for using credit facilities as a brake when construction activity threatens to climb beyond a level that can be sustained. If public and private lending agencies could devise sound means for raising mortgage rates, increasing down-payment requirements, shortening amortization periods and basing value appraisals upon normal rather than inflated costs, they might exert a healthy influence against the tendency of the construction bubble to inflate until it bursts.

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There is no royal road to sustained high level employment. There is not even a single path to assured construction stability—there are many paths, all strait and narrow and all paved with bruising cobbles. This is true for all other major segments of industry.

It is easier to seize upon a magic formula such as monetary control, or deficit spending, or any one of a score of others, than to undertake an intricate task of piecemeal exploration. But only the latter course will lead to prosperity.

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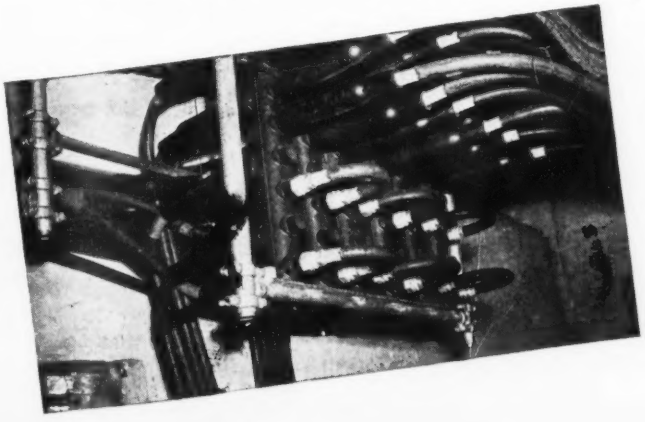

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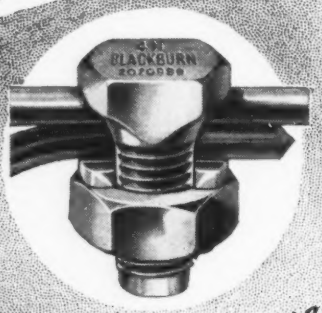

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EDISON TO SPEED WORK ON NEW BOULDER LINE

A million barrels of fuel oil for Pacific war needs will be saved annually by the immediate construction of a new Southern California Edison Co. major transmission line from Boulder Dam to southern California. Preliminary field work is in progress on the project, which will cost approximately $4,500,000. It will include construction of a 130-mile, 220,000-volt transmission line to connect with present facilities, and the building of a new major substation.

Every possible measure is being taken to speed construction, and it is estimated that the project will be completed and in operation the latter part of this year.

Although southern California now receives electric power mainly from hydroelectric sources, fuel oil is used in steam-electric generating plants which operate during peak demand. Because of the wartime importance of the new line in conserving fuel, WPB has granted special approval for the purchase of materials and securing the necessary manpower.

The 125,000 kw. of energy to be carried on the line will be generated at Boulder Dam by generators installed to supply power to the Metropolitan Water District and Basic Magnesium, Inc. Existing transmission facilities of the Metropolitan Water District will be used from the dam to Hayfield, a pumping plant of the district, located on the desert. From that point, the new Edison line will be built over a 130-mile route in western Riverside and San Bernardino counties to the new substation, to be known as Highgrove. The new station will supply the cities of Riverside, Colton, Redlands, San Bernardino and surrounding territory, supplementing existing facilities.

The new line will be the Edison company's third 220,000-volt circuit. It is being built under Edison supervision by Stone and Webster Engineering Corp.

B. C. Electric Schedules Bridge River Development

Plans for the construction of a 135,000-kw. hydroelectric power development on Bridge River, 110 miles northeast of Vancouver, B. C., were announced recently by W. G. Murrin, president of British Columbia Electric Railway Co.

Murrin said that plans for the development would be completed within the next 12 months and that construction will be started as soon as circumstances warrant.

CITY TO BRING MORE POWER FROM BOULDER

To permit the transmission of an additional 40,000 kw. of power from Boulder Dam, the Los Angeles Board of Water and Power Commissioners recently authorized completion of a nine-mile link between Receiving Stations B and D in southern and southwestern Los Angeles.

The unit will be the last in a 50- to 55-mile loop around metropolitan Los Angeles, tying together all receiving stations and termini of the Boulder Dam lines.

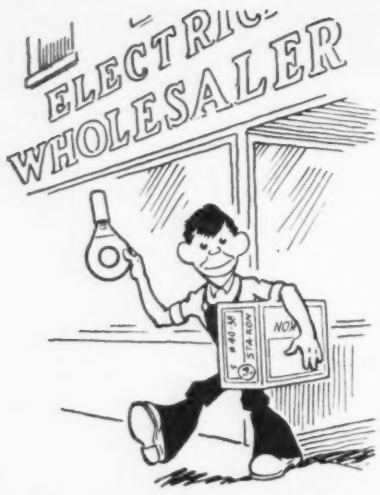
War Production Board priorities were obtained last summer and construction of 28,000 ft. of the line underground began. Civic and business organizations protested overhead building of the remainder of the line. The Water and Power commissioners pointed out, however, that the overhead lines will be $1,600,000 cheaper and it subsequently awarded contracts totaling $115,000 to launch the $189,000 overhead construction.

William S. Peterson, Bureau of Power and Light engineer in charge, explained that the city will utilize the Metropolitan Water District's Boulder Dam power which was transmitted to Basic Magnesium, Inc., near Las Vegas, Nev., until that plant curtailed operations. The additional hydroelectric power will make it unnecessary to bolster Los Angeles' power generation by burning fuel oil.

Seattle City Light Asks Budget for Expansion

Declaring that Seattle City Light's business is increasing to such an extent that expansion of its distribution system is necessary, Superintendent E. R. Hoffman has asked city council permission to spend $450,000 from the utility's surplus funds. The money would be spent as follows: Purchase of substation sites, $22,000; substation construction, $253,000; miscellaneous overhead line construction, $175,000. Hoffman also asked approval to spend $35,000 at Diablo, for children of City Light employees.

● Electrical Safety Week, stressing care of electrical appliances and inspection of wiring, was observed in the State of Washington April 22 to 28. Schools were urged to feature mechanics of home repair in their programs and children were issued forms to assist their parents in checking electrical safety in homes. Store and building managers also were asked to inspect their premises.



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CALIFORNIA-PACIFIC TO ACQUIRE MORE PROPERTIES

A move to acquire power generation and transmission facilities of the West Coast Power Co. in eastern Oregon was made by California-Pacific Utilities Co. of San Francisco early in April, with the filing of application with the California Railroad Commission.

Properties, which would be purchased by assumption of $200,000 principal amount of West Coast bonds and $175,000 cash payment, include a 1,560-kva. generating plant at John Day, Ore., and lines serving Burns, Prairie City and other surrounding towns.

California-Pacific Utilities last summer acquired electric utility properties serving Winnemucca, Nev., Malad City, Ida., and Cokesville, Wyo.

Southern Utah Power May Change Capital Set-Up

Southern Utah Power Co. has been authorized by the Public Service Commission to make certain changes in its capital set-up as a forerunner to the issuance of $840,000 of 5% first mortgage bonds. SEC approval of the bond issue is still to be secured.

The bonds would be sold to Mutual Life Insurance Co. Proceeds would be used to pay off $482,000 worth of 5½% first mortgage bonds, to call at par $121,000 worth of 6% debentures and to provide $200,000 in cash to help pay for a steam-electric generating plant under construction in Cedar Canyon.

● AUTHORITY to purchase electric properties of Public Utilities California Corp. in Del Norte County, Calif., has been granted the California Oregon Power Co., it was announced in mid-April by the California Railroad Commission. Purchase price of the facilities, which serve Crescent City and Smith River, is $175,000. Copco will construct a transmission line from its system to the newly acquired area at a cost of $150,000.

● PUBLIC SERVICE CO. of Colorado will return to natural gas customers approximately $4,000,000 awarded to it by the U. S. supreme court as over payment to Colorado Interstate Gas Co. since 1942, when the Federal Power Commission ordered a reduction in the city gas rate. President John E. Loiseau, in a public statement, declared that since the money was derived from customers, it will, with the court's approval, be returned to them. Some $3,000,000 of the money will go to Denver customers, under Loiseau's plan, and $1,000,000 to residents of Pueblo and Cheyenne, Wyo., where subsidiaries of Public Service Co. operate.

Mountain States Power Files Rate Reduction

Rate reductions amounting to 5% for all types of service were made by Mountain States Power Co. to about 57,000 customers in the Lander, Riverton and Big Horn Basin areas near Casper, Wyo., in April. New rate schedules, as filed with the Wyoming State Public Service Commission by the Casper division of the company, will save customers about $28,000 annually.

Reductions followed lowering by the Bureau of Reclamation of the cost of power delivered to the utility from the Shoshone power plant and a pilot plant on the Riverton reclamation project in Wyoming, it was reported.

● SUFFICIENT WATER in the Columbia River and its tributaries to care for any reasonable power load, with ample margin, was reported by E. N. Peterson of Portland, representing the Northwest Power Pool, at the recent annual meeting of the Columbia Basin Forecast Committee. Favorable regional prospects were reported by Walter E. Johnson, Washington Water Power Co., O. L. Lefever, Northwestern Electric Co., and Henry R. Stevens, Bonneville Power Administration.

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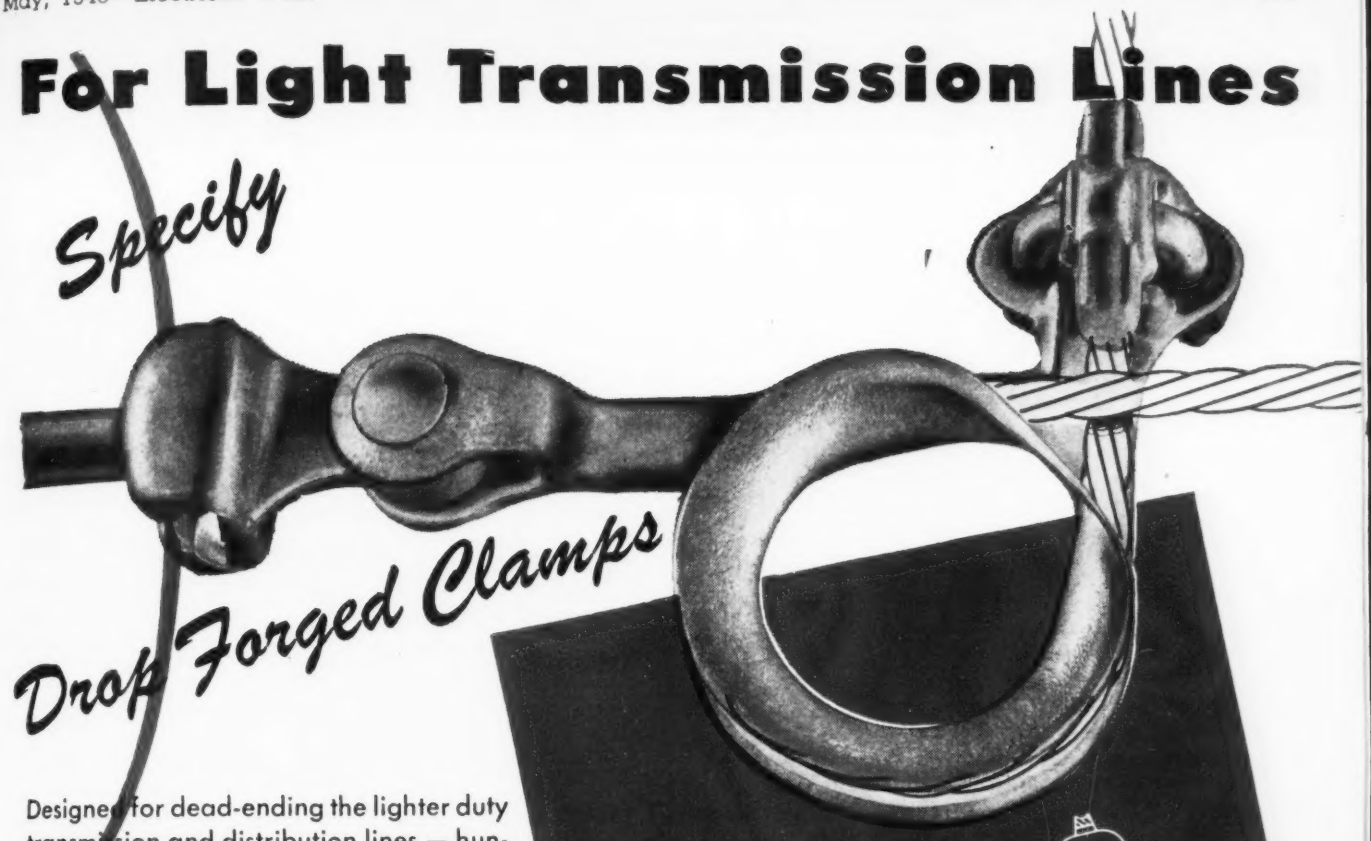

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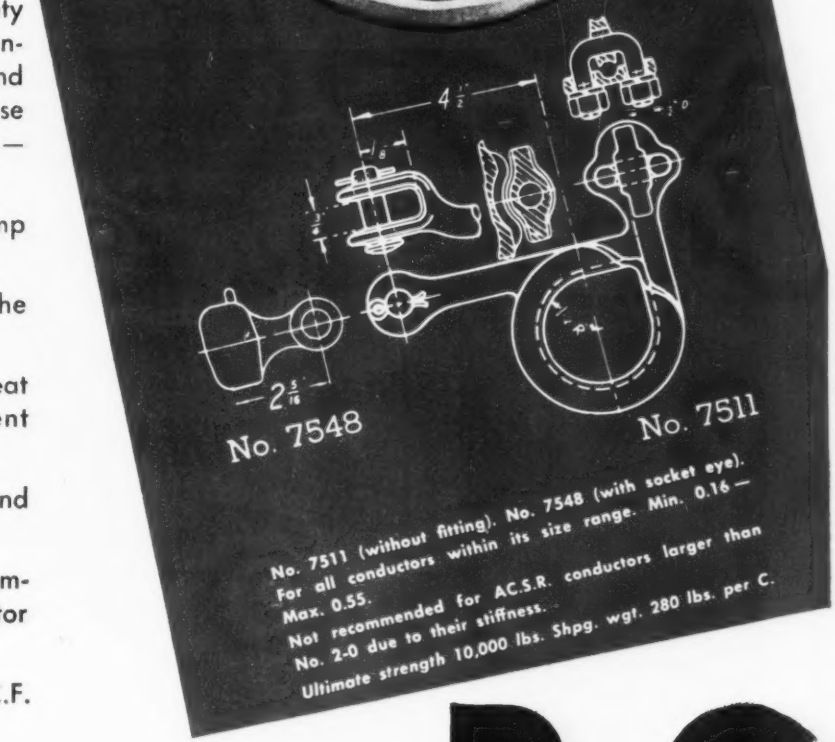

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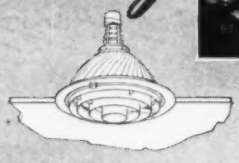

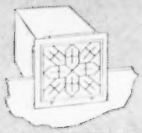

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RADIO TELEPHONE TESTED ON ELECTRIFIED RAILWAY

Whether radio-telephone communication for train systems, practical for mechanically driven railway trains, would work on an electrified railway system was proved satisfactorily in a test on the Chicago, Milwaukee, St. Paul & Pacific line, even 1,500 ft. inside the solid rock of the Snoqualmie tunnel, 40 miles east of Seattle, late in April. Engineers and officials carried on two-way telephone conversations with riders in the caboose and with dispatchers at way stations from the three-unit electric freight engine, halted in the 11,890-ft. tunnel.

Although transmission of radio-telephone communication from a moving train has been tested and proved on the Pennsylvania, Bessmer & Lake Erie, and Denver & Rio Grande railroads, the method of broadcasting on an electrified line is new.

Developed by the Union Switch and Signal Co. of Swissvale, Pa., the apparatus operates on a frequency modulation inductive principle, employing telephone wires paralleling the tracks, rails and high-tension trolley wires on electrified lines as wave transmitting mediums.

This use prevents the waves from "fanning" out and channels them along the right of way, eliminating "fading". The system uses an average of 88 kilocycles with an FM of 3 kilocycles ranging between 85 and 91 kilocycles. Voice frequency goes up to about 3,000 cycles giving a deviation ratio of one to one.

Advantage of the apparatus, according to Dr. P. N. Bossart, research engineer for the signal company, lies in the fact that the inductive system uses wires and rails, leaving radio channels for other uses. It sends out waves so weak that they do not exceed the limit specified by the Federal Communications Commission.

Competitive Bidding Up Before California Body

Utilities under jurisdiction of the California Railroad Commission which also are subject to Interstate Commerce Commission regulation and have an investment greater than $750,000 will have a chance to voice their opinions on competitive bidding in securities issues June 27 in San Francisco.

At an en banc hearing, utilities (with the exception of steam railroads) may show cause why competitive bidding should not become the policy of the commission, which heretofore has adhered to a negotiated sales policy.

CRIME INCREASES DURING BROWNOUT, DENVER REPORTS

Denver police, though cooperating diligently with national brownout restrictions, acknowledged a serious handicap in their crime prevention efforts during February and March 1945, according to a report made public a few days prior to the lifting of war production board's ban on outdoor lighting. Automobile thefts jumped 100% in February over the corresponding period of 1944; attacks on women and other crimes definitely fostered by darkness showed an ascendency: burglaries, thefts from parked cars and petty misdemeanors. Lower downtown areas were heavily patrolled while the brownout was effective, but other sections of the city, ordinarily well behaved, suffered under cover of the dimout.

● PUGET SOUND POWER & LIGHT CO. has salvaged more than 1,200 tons of scrap metal, vital to war industries, in a five-year period recently ended, according to Frank McLaughlin, president. The salvage includes 987,225 lb. of iron and steel, 882,314 lb. of copper, 619,113 lb. of lead, 26,735 lb. of brass and 10,436 lb. of lead-covered cable, as well as large quantities of aluminum, copper bronze, galvanized iron wire, German steel, zinc and rubber. The figures do not include paper, tires, tubes and materials salvaged by the company and redistributed over its system.

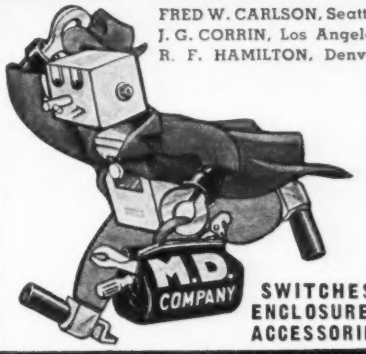
● IN A RECENT DECISION, the California State Railroad Commission authorized Pacific Gas and Electric Co. to place in its pension reserve fund $2,567,143 of the non-recurring tax reduction for 1945, resulting from its current refunding program. The Commission ruled that the remainder of the tax saving, totaling $1,719,857, may be credited to taxes accrued as a means of meeting additional tax charges which the Treasury Department claims are due for 1941-42.

● THE U. S. SUPREME COURT last month refused Pacific Gas and Electric Co. a rehearing on its decision holding the company to be a subsidiary of North American Co. The high court upheld SEC in an opinion handed down on March 12, after a four-to-four vote (ELECTRICAL WEST April, p. 100). Absence of a majority vote against the lower court automatically affirmed its decision.

● EXEMPTION from the War Production Board brownout through October 1945, has been requested from the Office of War Utilities by the Bonneville Power Administration following a review of Pacific Northwest power loads and resources. Present exemption from the order carries through July.

● REPRESENTATIVES of approximately 450 Seattle City Light workers have filed petitions with the city council for a $25 monthly pay boost, and have asked payment of overtime at time and a half instead of time off for work in excess of 40 hours a week, or eight hours a day. Local B-77 of the International Brotherhood of Electrical Workers joined in the request.

WESTERN REPRESENTATIVES
FRED W. CARLSON, Seattle
J. G. CORRIN, Los Angeles
R. F. HAMILTON, Denver



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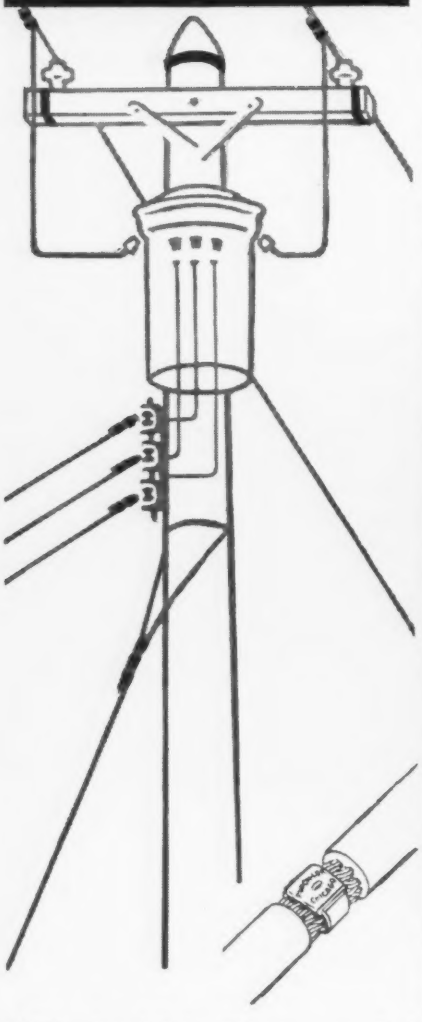

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PEOPLE
made this news

Bauer Heads Edison Board; Mullendore Now President

Election of Harry J. Bauer as chairman of the board and William C. Mullendore as president of Southern California Edison Co. was announced April 20 by directors of the company. Bauer and Mullendore had been president and executive vice-president, respectively.

Mullendore joined Southern California Edison as special counsel in 1925. He became general attorney in 1929, vice-president in 1930, and executive vice-president in 1931. He is a director and past president of the Pacific Coast Electrical Assn., a director of the Edison Electric Institute, a member of the American Bar Assn. and a past vice-president of the United States Chamber of Commerce.

BAUER

MULLENDORE

He received a J.D. degree from the University of Michigan in 1916 and the following year became assistant counsel for the United States Food Administration under Herbert Hoover. He was with the Army Air Service in 1918, liquidator and counsel for the Food Administration the following year and, in 1920, he represented the American Relief Administration in London and Berlin. He was assistant to Hoover in 1922 and 1923, when Hoover was Secretary of Commerce and subsequently practiced law in Los Angeles.

Bauer joined the company in 1908 as a member of the legal staff. In 1918 he was appointed general counsel and a year later resigned to go into private business. Named a member of the power company's board of directors in 1926, he became chairman of the board in 1932, president in 1933.

A graduate of the University of Southern California, he was awarded the Alumni Achievement Trophy in 1941. This award is made annually for accomplishments reflecting credit to the university.

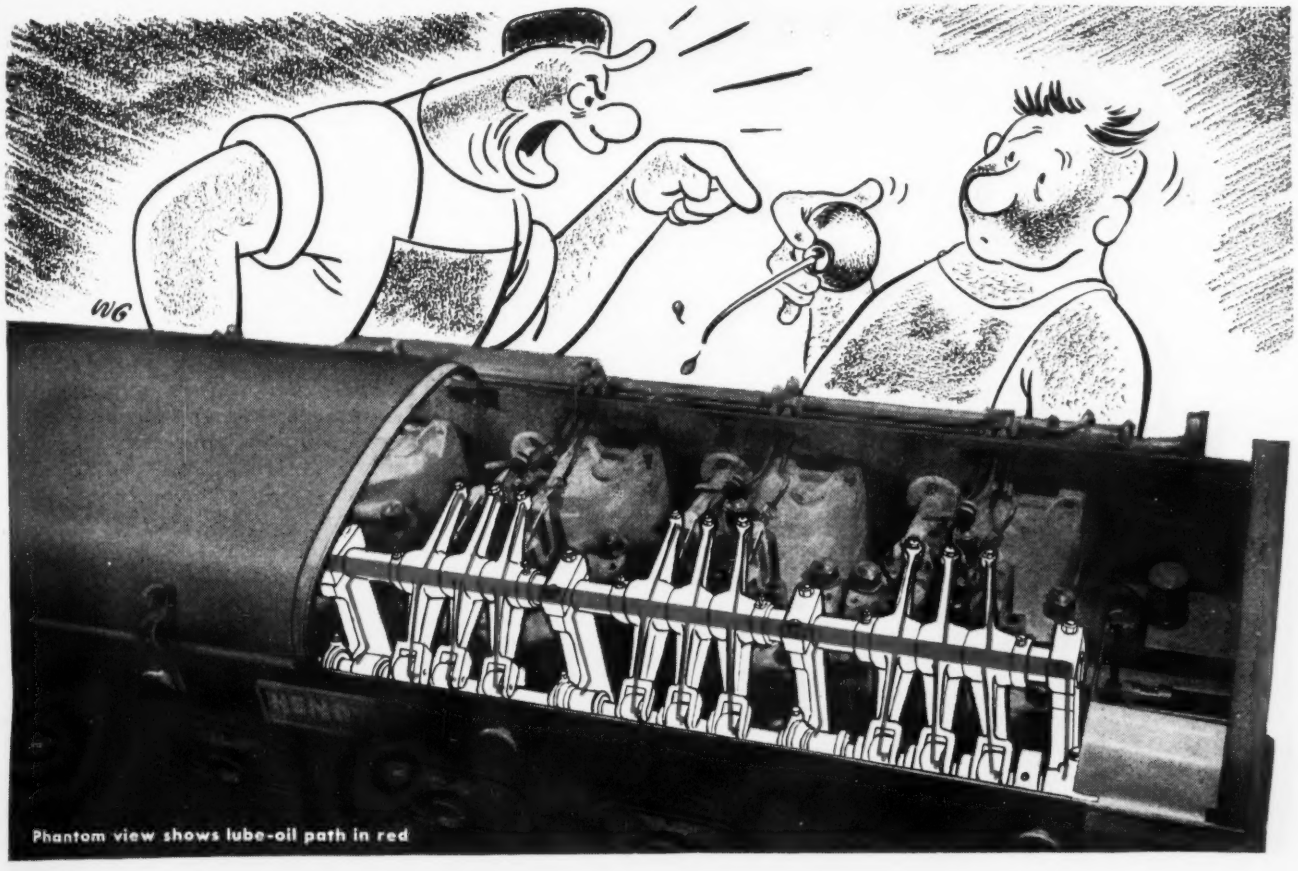
In announcing Mullendore's appointment as president, Bauer stated that the move had been contemplated for five years but had been delayed due to war problems.

Stockholders unanimously re-elected all directors: Bauer, Mullendore, Arch W. Anderson, Harry A. Buffum, John S. Cravens, A. N. Kemp, A. J. McFadden, William B. Munro, James R. Page, Charles H. Quinn, Harold Quinton, Alden G. Roach and Lane D. Webber.

Officers also were re-elected: Quinton, Webber, E. R. Davis, Will H. Fischer, N. B. Hinson, Gail C. Larkin, H. W. Tice, R. R. Walbridge and R. C. Kenyon, vice-presidents; O. V. Showers, secretary; B. T. Story, treasurer, and C. P. Staal, comptroller.

● J. N. A. HAWKINS, a native of San Francisco and formerly with the Disney Studios in Hollywood, has been named general sales manager of Sylvania's industrial electronic products. Hawkins developed the three-channel "fantasound" pilot tone recording and reproducing systems used in the Disney picture, *Fantasia*. Since 1941, he has been engaged in Naval warfare research and has served in Central and South America, Europe, Africa and Asia.

● GEORGE K. COMSTOCK, president of Electrical Products, Consolidated, Seattle, has been named president of the Rotary Club of Seattle.



Phantom view shows lube-oil path in red

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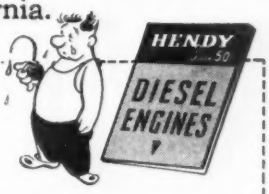

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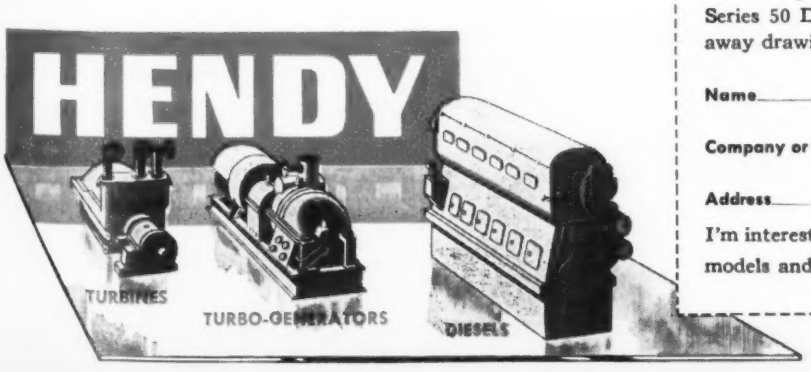
models and in hp ranges from 190-250 ☐ from 250 up ☐



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- IT CONFINES THE HEAT, FLAME AND MOLTEN METAL to the renewal element—protecting permanent parts of the fuse from damage. No scraping—no cleaning when renewal element must be replaced.
- IT HAS TIME-LAG EFFECT by keeping the fusible link cool when sudden overloads appear. You get the time-lag link PLUS the time-lag powder.

ONLY TRICO HAS THESE FOUR OUTSTANDING FEATURES . . . and they COST NO MORE!
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CINCINNATI, OHIO

Los Angeles Names Garman Chief Electrical Engineer

Appointment of Charles P. Garman as chief electrical engineer and a deputy general manager of the Los Angeles Department of Water and Power was announced April 24 by the city's Board of Water and Power Commissioners. At the same time, the commissioners named Laurence E. Goit to a corresponding post with the water bureau.

Selection of Garman to the $18,000-a-year post was made on the recommendation of Samuel B. Morris, who

GARMAN

recently succeeded H. A. Van Norman as general manager and chief engineer of the department.

Garman, who studied electrical engineering at the University of Southern California, worked for electric utilities and manufacturing companies prior to joining the Los Angeles Department of Water and Power as an electrical draftsman in 1920. He has been acting head of the power system since R. F. Robertson retired eight months ago. He is a member of the American Institute of Electrical Engineers.

Goit succeeds W. L. Hurlbut, who retired April 1. A graduate of Lewis Institute of Chicago, he has been with the Water and Power Department since 1924.

● W. E. LEE has been transferred from the Los Angeles to the Phoenix office by Westinghouse Electric & Mfg. Co. As an application engineer, he will serve the company's central station, mining and other industrial customers throughout Arizona. Before moving to Los Angeles, Lee had served Westinghouse at San Francisco, Butte, Las Vegas, Nev. and Salt Lake City.

Kent Resigns at Tacoma; Darland Superintendent

Resignation of Verne Kent, superintendent of the Tacoma (Wash.) City Light Department since 1933, and appointment of Alvin Darland, supervisor of construction, maintenance and operation at Grand Coulee Dam, was announced recently by Utilities Commissioner C. A. Erdahl. Kent's resignation and Darland's appointment as his successor became effective May 1.

In tendering his resignation, Kent stated his intentions were to resume his former position as foreman of wiremen with City Light. He has been with the department since 1917 and had been superintendent since January 1933. He will be eligible for retirement in June 1948.

Darland has been with the Bureau of Reclamation since construction was started on Grand Coulee, first as field engineer and later as supervisor of both the dam and the town of Coulee Dam. He is a native of Tacoma and was connected with City Light prior to joining the Reclamation service. In his earlier career, he was an engineer with General Electric at Schenectady, N. Y.

In his new position, Darland will also become Tacoma's chief electrical engineer, a position which was combined with that of superintendent of City Light in order to boost his salary from $5,400 to $9,000 per year.

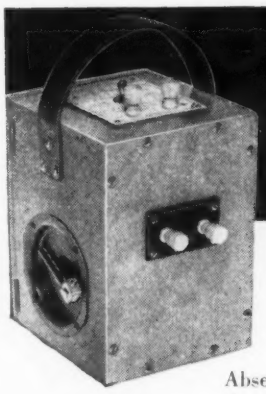
Marlett Advanced to New Post with Bonneville

Appointment of D. L. Marlett as assistant administrator of the Bonneville Power Administration, with headquarters in Portland, has been approved by Secretary of the Interior Harold L. Ickes. He succeeds Ulric J. Gendron, who has been transferred to the Central Valley Project in California.

Marlett joined the Bonneville staff in 1939 and served as executive assistant to Administrator Paul J. Raver until 1943, when he was appointed controller. Gendron had been with Bonneville since 1937. He left in April to become executive assistant to CVP Director Charles E. Carey.

● EDWIN B. HANSON has been appointed Pacific district transformer specialist for General Electric Co. with headquarters in San Francisco. His territory includes California, Nevada and Arizona.

● J. H. CLAWSON, assistant treasurer of Puget Sound Power & Light Co., has been elected to membership in the Controllers Institute of America.



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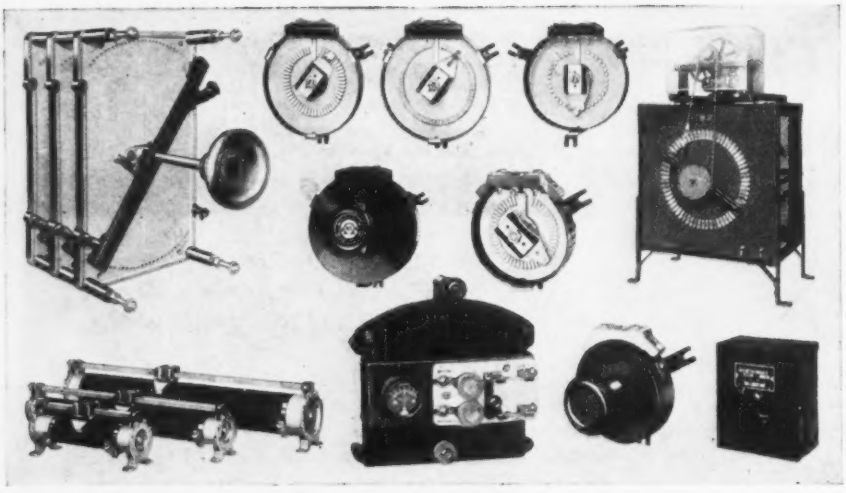

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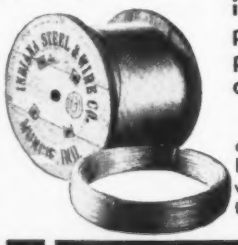

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INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

Zimmerman Named Utilities Director in Washington

Andrew J. Zimmerman has been appointed director of the Washington State Department of Public Utilities by Governor Mon C. Wallgren, it was announced in April following the division of the old Department of Public Service into departments of public utilities and transportation by the 1945 Legislature.

Zimmerman, former administrative assistant to J. Edgar Hoover, director of the Federal Bureau of Investigation, has served as FBI special agent in Seattle and Portland, and in January became a special investigator for Governor Wallgren.

● ARTHUR D. BRAGG has been transferred back to San Francisco by General Electric Co. to take over the duties of Pacific district manager of the central station-transportation department. This post was left vacant when Allen G. Jones was appointed manager of apparatus sales for the district. Bragg was moved to Los Angeles last July as assistant to the manager of that office. Previously he had served the company in San Francisco and in the Fresno branch.

● PETER L. LENZ has been appointed manager of the Westinghouse Pacific Coast district manufacturing and repair department. He comes to the West from Philadelphia, where he held a similar post in the Middle Atlantic district. He will have charge of the department plants in Emeryville, Calif., Los Angeles, Portland, Seattle and Salt Lake City.

● BERT WIGGENSTEIN has been named Seattle manager of the Westinghouse department of apparatus and supply to succeed WILLIAM BAILEY, who was transferred to utility sales. Wiggenstein has been with Westinghouse for 25 years, much of that time in Butte, Mont.

● WILLIAM TRUDGIAN, with Westinghouse Electric & Mfg. Co. at Salt Lake City for the past 18 years, has been named manager of the company's agency and specialties division in Seattle. He replaces RALPH COLBURN, who is now with Westinghouse Supply at Oakland, Calif.

● CAPT. JOHN J. HEALY, who for 33 months has been with the Army Air Forces, has been assigned to inactive duty and has resumed his former post as representative for the Copperweld Steel Co. His territory includes the state of Montana.

● IRVING K. HARRIS, until recently power director at Boulder Dam, has been appointed acting construction engineer at Shasta Dam to succeed Ralph Lowry, recently promoted to assistant chief engineer of the Bureau of Reclamation with headquarters in Denver, Colo., it was announced late in April. Before joining the reclamation service in 1909, Harris was associated with the Edison Electric Co., now the Southern California Edison Co., and from 1917 to 1933 he was a consulting engineer in Los Angeles. From 1912 to 1914 he was engineer in charge of the power division of the Salt River Project in Arizona.

● HENRY R. HUBER has been appointed Northwest field engineer for Benjamin Electric Mfg. Co., with headquarters in Seattle. His territory will include Washington, Oregon, Idaho and Montana. Huber was designing electrical engineer with the U. S. Army Engineers in San Francisco from February 1942 until September 1944, when he became plant engineer for the Berkeley Tool & Die Co. Previously he was employed by Pacific Gas and Electric Co. for 12 years, six of them as lighting specialist.

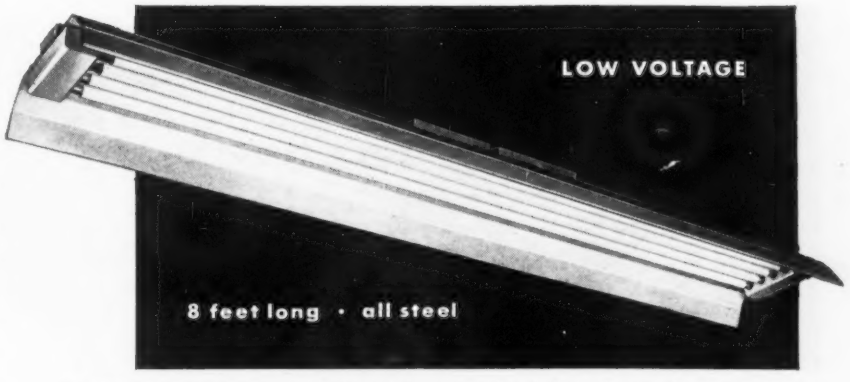
● C. H. "CHIEF" WILSON has been appointed assistant sales manager of the consumer products division of Adel Precision Corp., Burbank, Calif. Wilson has spent more than 25 years in the distribution and sale of household appliances and has been associated with Leo J. Meyberg, San Francisco and Los Angeles, and Strong, Carlisle and Hammond, Cleveland, Ohio. He also was with General Electric Supply at one time, as manager of the Cleveland district.

Deaths

● JOSEPH "DANNY" DANNHEISER, one of the pioneers of the electric industry in the Bay area and for many years with the Autocall Co., died at Stanford Hospital in San Francisco on April 5. Mr. Dannheiser was designer of alarms and fire protection equipment under the name of his own company, the EB-E&ES Co. He was active in the electric clubs of the Bay area.

● EDWARD C. CONKLIN, 39, superintendent of Moon Lake Electrical Assn., an REA system at Mt. Emmons, Utah, was electrocuted in April at Tabiona, Utah, while endeavoring to remove a tree from a power line which he thought was dead. Mr. Conklin was born in Rupert, Ida. He had been a resident of Altonah, Utah, since 1922.

*COLOVOLT COLD CATHODE INDUSTRIAL FIXTURES



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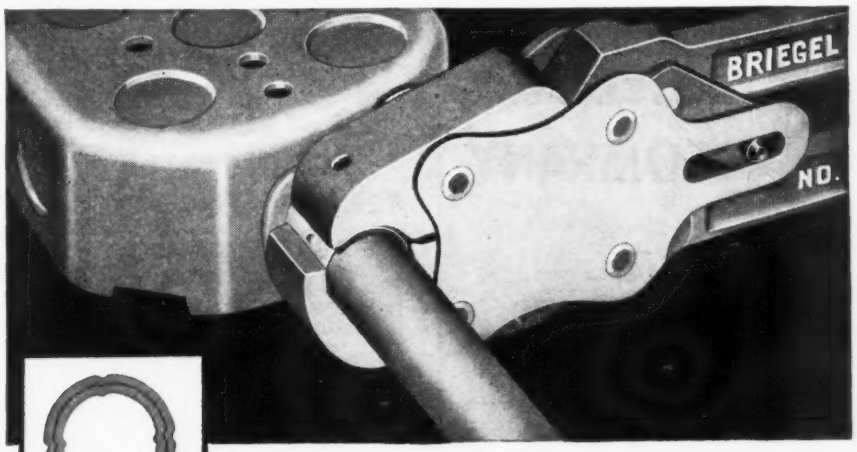

Cross section Showing Indentations.

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Gen. Electric Co., Bridgeport, Conn.
The Steelduct Co., Youngstown, Ohio
Enameled Metals, Pittsburgh, Penn.
National Enameling & Mfg. Co., Pittsburgh, Pa.
Triangle Conduit & Cable Co., New Brunswick, N. J.

Prompt Deliveries on Properly Rated Orders

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Give Better
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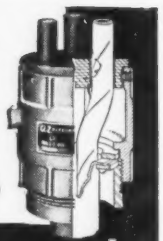
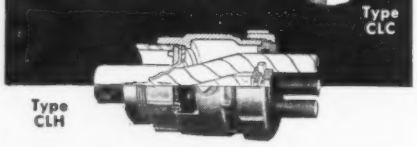


Type CLC



Type CLH

Designed for Vertical and Horizontal Conduit Positions

Both type terminators shown are for use with a single or a multiple conductor lead covered cable up to 750 volts and are similar in design except that the Type CLH is sealed at both ends. These types are also available for two or more lead covered cables and for rubber covered cables.

A number of other type terminators including a series for cables up to 2500 volt capacity are also listed in our catalog. Write on your business letterhead for free copy.

O.Z. ELECTRICAL PRODUCTS
- Conduit Fittings
- Cable Terminators
- Junction Boxes
- Solderless Connectors
- Power Connectors
- Grounding Devices

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TRADE *notes*

Firm Offers Consulting Service in the West

Electronic Chemical Engineering Co. has been formed at Los Angeles to assist manufacturers in developing new processes and in solution of problems in connection with the application of dielectric and induction heating. The company manufactures no equipment, specializing in engineering and research-development work.

Due to the tremendous advancements and knowledge gained as a result of the war, many new developments in induction and dielectric or high-frequency heating can now be engineered into present and postwar industrial operations, which will speed and increase assembly line operations, make better products available, reduce handling costs, increase employment.

Electronic Chemical Engineering Co., 951 La Cienega Blvd., Los Angeles, Calif., is composed of a group of research-development engineers and specialists, who for the past several years have been leaders in the electronic and chemical fields. Their services are available in the West on a consulting basis.

● ERECTION of a new plant is proposed by the Electric Panel Mfg. Co. Ltd., 1250 Richards St., Vancouver, B. C., at a cost of around $35,000. The new building will house a large workshop, stock room, and general and private offices. It will be 90 by 120 feet in ground area. Production of electric panels, switchboards and switches has been carried on by this company in Vancouver for 19 years, and since 1934 the plant at the Richards street address has been in operation.

● LEO J. MEYBERG Co., San Francisco and Los Angeles, is distributing the Pierceway plastic duct wiring systems in California. The system carries continuous buses in a plastic duct and has receptacle tap outlets at regular intervals. Like metal moldings of similar type, a variety of fittings is available to provide special lock or pressure receptacles and elbows for corners, dead ends and wiring access fittings. Priority of AA-5 is required for it now.

● HOMER L. HUSSEY and G. A. O'BRIEN of Phelps Dodge Copper Products Corp. have moved from King and Occidental to new quarters in the Smith Tower, Seattle.

● WESTERN representatives of the newly established General Electric air conditioning department are E. W. Howes and W. H. Stover. Stover will handle the Northwest territory from headquarters in Seattle; Howes will headquarter in San Francisco and will handle the states of California and Arizona and part of Nevada. Establishment of the new department as one of its six major operating departments was announced recently by G-E. Headquarters are at Bloomfield, N. J., with George R. Prout as general manager. Heating, air conditioning and commercial refrigeration previously had been handled by the appliance and merchandising department.

● WARTIME ENGINEERING accomplishments which have a ready peacetime application were described by Marvin W. Smith, Westinghouse vice-president, in a series of talks presented in the West last month. Smith is in charge of all engineering for the company and is responsible for its research laboratories. Modification of the tank-gun stabilizer to make trains and buses ride more smoothly, an electronic air cleaner for the home and adaptation of war plane improvements to postwar airliners are only some of the possibilities he mentioned.

● PROCTOR ELECTRIC CO. has announced appointment of Donald H. Sluman as Denver district manager, with headquarters in the Interstate Trust Bldg. there. Another recent Proctor appointment is that of A. H. Buchanan as district manager of a territory which includes parts of Montana and Wyoming, in addition to several Midwest states.

● RESIN INDUSTRIES, Santa Barbara, Calif., has announced the appointment of F. M. Nicholas Co. of San Francisco as northern California and western Nevada representative. The Nicholas company, which is located at 1123 Harrison St., will give service on matters pertaining to properties of Resinite flexible plastic tubing, tape and sheet materials.

● A. F. KRIPTNER, 760 Downing St., Denver 3, Colo., has been appointed sales agent for the Pacific Electric Mfg. Corp., San Francisco, according to Edward F. Sixtus, vice-president of the company. Kriptner will service the states of Colorado and Wyoming.

● M. L. FOWLER, formerly Los Angeles representative of Benjamin Electric & Mfg. Co., has formed a company of his own in San Francisco as manufacturers' representative. His office is at 163 Second St.

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Saves hours and steps.. buy from the IWI Blue Catalog.

VARSLOT INSULATION

Reduces breakdowns due to grounds..provides greater mechanical strength as well as higher dielectric strength.

VARTEX VARNISHED CAMBRIC INSULATION

Provides defense against motor breakdowns through unexcelled protection against oils, moisture, acids and alkalies.

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Pacific Coast Representation

A firm consisting of three partners who possess extensive business and merchandising experience on the Pacific Coast, particularly in the San Francisco area, is desirous of contacting manufacturers who contemplate renewing or establishing agencies on the Pacific Coast. Satisfactory references can be furnished. Write King, Shea & Poston, 604 Mission St., San Francisco 5, California.

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THE POPULAR TIME SWITCH LINE KNOWN EVERYWHERE

There is a Tork Clock for every regular switching job; 60 minute, 4 hour or daily cycles.

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10 to 50 Amp.
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A complete line of automatic time switches for practically every installation. Highest quality construction with a record of dependable service for nearly 35 years. Specify Reliance Time Switches and be sure you are specifying the best. Catalog on request.

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1929 Mead Street Racine, Wisconsin

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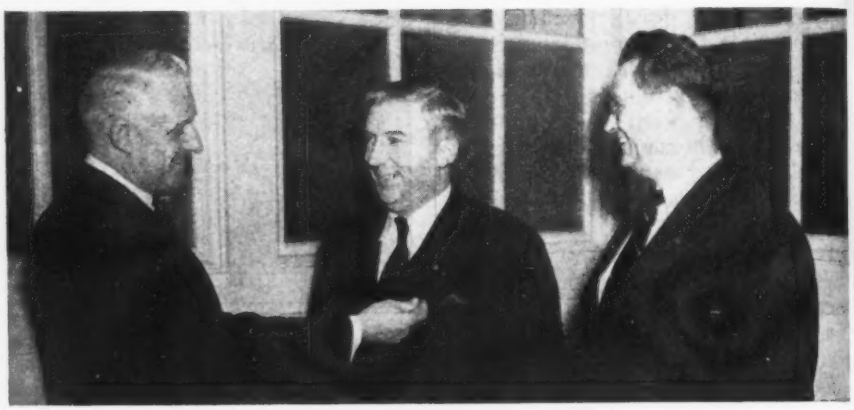
PROFILES *of the month*

Arthur D. Bragg (left) pictured at San Francisco last month with Allen G. Jones, whom he succeeds as Pacific district manager for G-E's central station and transportation department

Below: Edward F. Sixtus (center) receives a pin for 36 years of continuous service with Pacific Electric Mfg. Corp., San Francisco. General Manager William R. Marshall makes the award and Henry Brooke, a 25-year man, looks on. Sixtus holds the company's longest service record. He was given a "temporary" job as a boy, 36 years ago; is now vice-president in charge of sales



Below: Newly elected officers of the San Diego Electric Club. From left (seated) Marvin Musgrave, San Diego Gas & Electric; second vice-president; Oscar G. Thompson, G-E Supply, first vice-president; William W. Powell, Coast Electric, director; President George R. Gray, San Diego G & E; (standing) F. D. Ide, Don Lee Broadcasting System, A. H. Jewell, Graybar, Frank Porath San Diego G & E, Bart A. Murray, Electric Supplies Distributing, directors; Don Sylvester, San Diego G & E, secretary-treasurer

TO THE MEN OF MANY NATIONS WHO MEET IN PEACEFUL COUNCIL IN THE CITY OF ST. FRANCIS

You have the prayers of millions attuned to your deliberations. What you determine will be a flame raised high for All the World—an augury of hope and faith for the Peace to come ☆ May you visit us again, when the bells proclaim fulfillment of your historic labors.

Prayer of Peace

ST. FRANCIS OF ASSISI · 1182-1226

LORD, make me an instrument of Thy peace.
Where there is hatred, let me sow love.
Where there is injury, pardon.
Where there is doubt, faith.
Where there is despair, hope.
Where there is darkness, light.
Where there is sadness, joy.

O DIVINE MASTER, grant that
I may not so much seek
To be consoled, as to console;
To be understood, as to understand;
To be loved, as to love;
For it is in giving, that we receive.
It is in pardoning that we are pardoned.
It is in dying, that we are born to eternal life.

E. W. 17X-545

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Electric Wiring can be Inadequate, too!

The wiring in every home should be "big" enough to do its job properly. Yet thousands of homes on the Pacific Coast—many of them built in wartime—are wired inadequately. Re-wiring these homes properly as soon as wartime restrictions are lifted, represents a big postwar opportunity for virtually the entire electrical industry. As the number of adequately wired homes increases, the market for new electrical appliances also will expand. Electrical equipment manufacturers, dealers, electrical contractors and utilities *all* will benefit. The time to start planning *your* share in this coming opportunity is *now*. Base your plans on adequate wiring.

PACIFIC COAST ELECTRICAL ASSOCIATION

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